SAFETY MEASURES IMPLEMENTATION MODEL FOR SMALL AND MEDIUM SIZE CONSTRUCTION FIRMS IN ABUJA, NIGERIA

BY

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PhD/SET/2018/9166

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ABSTRACT

With the rapid and increasing economic development and industrialisation, the construction industry continues to rank among the most hazardous industry all over the world and therefore poses a serious threat to workers and non-workers. Most construction firms especially those within the small and medium size category lack strategies for implementing safety measures on construction projects. Therefore, this research is aimed at developing a model for implementation of safety measures for small and medium sized construction firms (construction SMEs) in Abuja with a view to improving the safety performance of construction firms. Primary and secondary data were obtained from various construction SMEs through a well-structured questionnaire distributed to 353 randomly selected respondents with a response rate of 56%. Mean Item Score (MIS), multiple regression and structural equation modelling (SEM) were statistical tools employed for the analysis of data. The findings revealed that use of First aid kits with MIS of 4.28 is the most effective safety measures required on construction SMEs. It was also found that low level of compliance with Occupational Health and Safety regulations with MIS of 4.21 is the most severe challenge affecting the implementation of safety measures by construction SMEs. Cost of workmen's compensation with the MIS of 3.79 is the most significant effect of implementation of safety measures on the cost of accidents. While Health &Safety (H&S) provision in condition of contract with MIS of 4.15 was ranked as the averagely implemented regulations for enhancing effectiveness of safety measures. The results from the regression analysis showed a predictive value of 0.7%, and 4% of the constructs. The values were very low, hence regression had a low predictive ability. Therefore, a higher analytical technique Partial Least Square-Structural Equation Modelling (PLS – SEM) was chosen to gives a higher predictive power as compared to regression analysis and was used to validate the model. The findings from the SEM revealed that the data was acceptable as six of the construct tested were significant. However, three (3) were rejected for this model. The research has developed a conceptual model for the implementation of safety measures for construction SMEs based on the results and informed by the theoretical framework. The study has achieved its aim of establishing an understanding of the issues leading to an improved implementation of safety measures and as well as their management in the Nigerian construction SMEs. This study concludes that Communication of H&S policy and programs to staff is the most effective strategy that can improve the level of implementation of safety measures on construction SMEs. Therefore, this research recommends that construction SMEs should improve the compliance with H&S regulations of firms by ensuring that all the safety measures are restructured to be in line with H&S regulations. Organisations and construction stakeholders should use the model developed to put measures in place to curb barriers inhibiting safety measures implementation and improve on the safety measures of construction SMEs in order to enhance firm's competitive advantage and boost performance.

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ABBREVIATIONS

ACoP	Approval Code of Practice
AHP	Analytic Hierarchy Process
CAC	Corporate Affairs Commission
CDM	Construction Design Method
CJSA	Construction Job safety Analysis
CPE	Collective Protective Equipment
CPM	Collective Protective Measures
DOSH	Department of Occupational Health and Safety
EFQM	European Foundation Quality Model
FOCI	Federation of Construction Industry
FCT	Federal Capital Territory
GDP	Gross Domestic Product
H&S	Health and Safety
HaSPA	Health and Safety Professionals Alliance
HSE	Health and Safety Executive/Health, Safety and Environment
HSO	Health and Safety Officers
HSWA	Health and Safety at Work Acts
ILO	International Labour Office
IRGC	International Risk Governance Council
ISO	International Organisation for Standardisation
MIS	Mean Item Score
NBS	National Bureau of Statistics
OHS	Occupational Health and Safety
PMIS	Project Management Institute Staff
PPE	Personal Protective Equipment
SMEDAN	Small and Medium Enterprises Development Agency of Nigeria
SMEs	Small and Medium –Sized Firms
SMS	Safety Management System
UK	United Kingdom
WHO	World Health Organisation

DEFINITION OF TERMS

i. **Accident:** Accident can be defined as *"*an unplanned event that results in injury or ill health of people, or damage or loss to property, plant, material or the environment or a loss of a business opportunity*"*. There are different types of accidents in the construction industry. HSE (2006) classified accidents in the construction industry as fatal and non-fatal (major and minor injury). Accident is an impromptu occasion that resort into injury of individual or damages to property, plant, materials or environment or loss of business opportunities.

ii. **Health:** Longman's Dictionary of Contemporary English, define Health as a point of well-being both in body and mind and free from unknown injury. It is also defined as the assurance of the body and psyche of individuals from anticipated injury coming about because of materials, procedures or strategies utilized as a part of the working environment.

iii. **Health and Safety (H&S):** The borderline between health and safety is ill-defined and the two words are normally used together to indicate concern for the physical and mental well-being of the individual at the work place. HSE (2006) defined health and safety *as* "about preventing people from being harmed or killed at work".

iv. **Health and Safety Best Practices (H&S Best Practices):** These are good practices that have been identified and developed by researchers as procedures capable of improving the H&S performance of construction firms if adopted as policies by the firms.

v. **Health and Safety Regulations (H&S Regulations):** These are laws on H&S activities capable of improving the safety performance of construction workers on sites or that of the construction firms. Most of these Regulations are foreign based (OSHA, CDM.) and some are local (National Building Code 2016) and Workmen's Compensation Act, 2006) and are either not for the construction industry or they may be restricted to specific location or they may even be too generic.

vi. **Safety:** Safety is the key to achieving success in construction project, it is a state of being free from harm. Safety can also be defined as the protection of people from physical injury (Hughes, 2008). In other word Safety is a state of being secured from accidents, hazard, injury or death due to measures put in place to prevent such from happening.

vii. **Safety Measures**: These are the procedures required on construction sites preventing or reducing safety risks, accidents and hazards on sites and these procedures are company's H&S policies drafted from H&S Regulations and Best Practice (Hughes and Ferret, 2016).

viii. **Small and Medium Enterprises (SMEs):** SMEs are broadly defined as business with turnover of less than 100 million per annum and/or less than 300 employees

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

The construction industry is an important sector of the economy in many countries and it is often seen as a driver of economic growth by contributing to Gross Domestic Product (GDP), capital formation, and employment especially in developing countries (Fatemeh and Serah, 2020). Furthermore, Tochi *et al.* (2021) stated that the construction industry in developing countries has consistently underperformed in the area of Health and Safety (H&S), and Nigeria is no exception. Similarly, Manu *et al*. (2018) posited that the construction industry in developing nations like Nigeria has a high rate of fatal injuries and continues to be the highest among all industries; this is owing to the fact that Nigeria's current Occupational Health and Safety(OHS) laws is not functional (Umeokafor *et al.*, 2014).

Consequently, despite the industry's importance, it is regarded as hazardous, with frequent and high accident rates, as well as health issues affecting workers, practitioners, end users, and the general public (Kadiri *et al.*, 2014).Accident and injury rates are often regarded to be greater in developing countries such as Nigeria than in developed countries (Ibijoju, 2016). This has been ascribed to lack of proper H&S management procedures being considered during the construction project delivery process (Belel and Mahmud, 2012).Safety should be a top priority for employers, according to Ibukun and Olaotan (2012), but only the larger-sized firms in the construction industry in Nigeria is seen to prioritize employee’s safety.

Adeogun and Okafor (2013) asserted that the implementation and adoption of OHS in Nigeria is still at preliminary stages. Similarly, Diugwu *et al.* (2012); Okolie and Okoye (2012) stated that the government in Nigeria has paid little attention to OHS.

OHS regulatory system in the country does not encourage mandatory reporting of accidents. However, Diugwu *et al.* (2012) blamed the gap in the implementation of OHS regulatory system in Nigeria on the dysfunctional H&S laws in the country. As a result, the construction industry in the country is clearly unregulated in relation to OHS because it is not covered by the existing Factories Act LFN 2004 (Idoro 2008; Diugwu*et al*., 2012); yet some construction firms especially multinationals adopt international legislation (Qi *et al.*, 2022).

Multinational construction firms, according to Windapo and Jegede (2013), have a very good system in place for managing H&S and consequently have better H&S records. Some of these firms develop policies and safety programmes so as to protect their reputation in the developing countries and to reap the benefits of improved H&S such as higher productivity (Okoye, 2018). However, the implementation of the standards and legislation is at the discretion of the adopters (Idoro, 2008). Okoye (2018) also observed that model for the implementation of safety measures is generic and applies mainly to the large-scale multinational construction firms. Therefore, little or no emphasis is laid on the safety measures for small and medium sized construction firms (construction SMEs) in Nigeria.

Safety measures mainly involve the procedures and strategies that should be put in place to prevent or minimise accidents at various stages of construction. These procedures are company's H&S policies drafted from H&S Regulations and Best Practices (Okeola, 2009). The significance of OHS in terms of hazards and accidents mitigative measures to workers are provisions for the use of first aid, protective wears, safety signals, monitoring and enforcement. Awwad *et al.*(2016) added that safety measures in Nigerian construction industry lack necessary implementation due to absence of proper monitoring system, low level of safety awareness and inadequate support from safety managers. Frequent building and construction accidents and incidents are linked to reduced operational efficiency, increased costs, reduced profitability and shareholders' values (Hecker and Goldenhar, 2014; Jebb, 2015). Unless safety measures areeffectively embraced as part of the organisational culture and integrated in the conceptualisation, design, scheduling and implementation of a project, frequent accidents and incidents can therefore easily affect the existence, sustainability, and competitiveness of a construction firm (Hemamalinie *et al.*, 2014; Jebb, 2015).

Since it has been discovered from available literatures that the Nigerian construction SMEs lack model for implementing safety measures in construction projects, it is important for the construction industry and all stakeholders to identify proactive safety measures from literature and H&S organisational culture of construction firms. This will build up a solid background for developing an effective and implementable model for implementing safety measures by construction SMEs. Hence, the need for this research.

1.2 Statement of the Research Problem

Construction industry has geared efforts towards improving its H&S performance (Dodo, 2014). However, these efforts have been shifted from monitoring safety performance to preventive measures for improving safety performance. In its efforts to address the developmental initiatives of many nations, including Nigeria, the industry's H&S performance continues to be a glaring concern (Okoye and Okolie, 2014).

Accidents not only result in considerable pain and suffering but also retard project productivity, quality, and time and consequently add to the cost of construction (Okoye and Okolie, 2014). However, cost implication of H&S prior to tendering and during construction are rarely considered during budget and often not discussed in site meetings by the relevant stakeholders for the Nigerian construction SMEs (Diugwu *et al.*, 2013). H&S has therefore been a major source of concern for employees, employers and government for the past decades globally (Olutuase, 2014).

Diugwu *et al.* (2013) opined that Nigeria is among the countries paying little or no attention to H&S measures and regulations where small and medium sized construction firms allocate little or no resources to H&S management.. In the same vein, Bima *et al*. (2015) revealed that legislation on H&S are endorsed by the Nigerian government, including International Labour Organisation (ILO) conventions. However, their implementation by the relevant government bodies and workers is poor (Shittu *et al*., 2015a and b; Shittu *et al.*, 2016; David *et al*., 2018). The regulations of H&S in Nigerian construction industry has received little attention, with little emphasis to strict adherence to safety in the SMEs and very minimal impact made by the inspection officers towards ensuring strict compliance (Agbede,2016).

Despite several contributions from scholarly literature reviews, there still exists some weakness in previous studies of safety measures implementation models developed such as: development of a framework of construction safety culture in Indonesia (Machfudiyanto and Yusuf, 2017). Zid *et al.* (2018) conducted a similar study in Malaysia to develop a conceptual framework for safety measures in construction industry. Agumba (2013) developed a conceptual model for construction H&S performance improvement for SMEs in South Africa. Majority of these past studies are specific to the countries under review which may not be directly applicable to the Nigerian construction SMEs. This is because SMEs and large organisations are different in terms of their characteristics. Large organisations are more properly resourced and organised than SMEs.

Summarily, studies on a model for effective implementation of safety measures by SMEs in Nigeria are scarce as the existing ones, such as safety culture development in the Nigerian building and construction industry (Boniface, 2016) ;development of framework for implementing safety on construction sites (Ahmad and Malik, 2013); and construction safety measures implementation status in Nepal construction industry (Sunil and Hari,2019), are too generic and are particular to foreign and multi–national construction firms which are characterized with shortcomings of not capturing the peculiarities of Nigeria.

Awwad *et al.*(2016) added that safety measures lack necessary model for the implementation of workplace safety procedures on construction sites with particular emphasis to the small and medium sized construction firms and thus leading to increase in accidents on construction sites; cost of compensation to injured workers; de-motivation of workers; reduction in productivity; and increase in project cost. This brings about poor safety performance and hence ineffective cost performance of projects. It is against this backdrop that this research focused on the development of model for implementation of safety measures for construction SMEs in Nigeria

1.3 Research Questions

In order to address the objectives of the research, the following questions were answered:

i. How can the level of implementation of effective safety measures required by construction SMEs be determined?
ii. What are the factors influencing the implementation of safety measures on construction sites by construction SMEs?
iii. What is the effect of implementation of safety measures on the cost of accidents?
iv. What are the strategies for improving the level of implementation of safety measures on construction sites by construction SMEs?
v. How can a model for the effective implementation of safety measures on construction projects by construction SMEs be developed?

1.4 Aim and Objectives of the study

1.4.1 Aim of the study

The aim of this research is to develop safety measures implementation model for small and medium size construction firms with a view to improving safety performance of construction SMEs for better productivity.

1.4.2 Objectives of the study

In order to achieve the aim of the study, the following objectives were formulated to:

i. Determine the level of implementation of effective safety measures required by construction SMEs;

ii. Examine the factors influencing the implementation of safety measures on construction sites by construction SMEs

iii. Determine the effect of implementation of safety measures on the cost of accidents by construction SMEs;

iv. Examine the strategies for improving the level of implementation of safety measures for construction SMEs; and

v. Develop an implementation model for effective safety measures for construction SMEs.

1.5 Research Hypothesis

Based on the objectives of the study and review of literature relating to the study's objectives, the following hypotheses were formulated:

H_01: There is a direct relationship between factors influencing the implementation of H&S measures and strategies for improving implementation of safety measures.

H_02: There is a direct relationship between factors influencing the implementation of H&S measures and cost of accidents in the construction SMEs

H_03: There is a direct relationship between barriers influencing the implementation of H&S measures and H&S measures required on construction SMEs.

H_04: There is a direct relationship between cost of accidents and strategies for improving implementation of H&S measures.

H_05: There is a direct relationship between cost of accidents and H&S measures.

H06: There is a direct relationship between strategies for improving implementation of safety measures and improved safety measures.

H07: There is a direct relationship between cost of accidents and improved safety measures.

H08: There is a positive and direct relationship between H&S measures and improved safety measures.

H09: There is an indirect relationship between barriers influencing the implementation of H&S measures and improved safety measures.

1.6 Justification for the Study

The situation of H&S on construction sites is a global problem and it is even more predominant in many developing countries including Nigeria. Efforts from previous studies on H&S on construction sites have been carried out globally and locally. On the global scene, studies have been carried out on the effect of safety provisions, practices on safety performance of construction firms (Kheni *et al.*, 2008); development of framework for measuring the effectiveness of common fall prevention practices. Agumba (2013) developed a conceptual model for H&S performance improvement for construction SMEs in South Africa. .Esmaeil *et al*. (2012) attempted conceptualizing the cost of safety in the model to describe the cost-benefit analysis of accident prevention.

In addition to these, Aminbakhsh *et al*. (2013) also investigated the safety risk during planning and budgeting of construction projects using an analytic hierarchy process (AHP).Mohd and Ahmad(2016) also developed a conceptual framework for safety and healthin construction management with the aim to fill the gap from pre-construction stage to construction stage. .Boniface (2016) presented a safety culture development model for the SMEs in the building and construction industry..Sousa *et al*. (2014) presented an occupational safety and health potential risk model for estimation of the statistical costs of occupational safety and health risk.

Several other safety research efforts have attempted to develop a framework for the implementation of safety measures on construction sites on a global scene (Umoh andTorbira, 2013). Such studies include that of Ahmad and Malik (2013) on the development of framework for implementing safety on construction sites. A similar research was also undertaken by Sunil and Hari(2019) on construction safety measures implementation status in Nepal construction industry. Gurcanli *et al.* (2015) observed that studies on the cost of safety measures as a part of project costs during a construction project are very rare. This is a gap left by these studies from the global scene.

The Nigerian construction industry researches carried out on H&Sinclude: application of H&S plan in Nigerian construction firms (Dodo, 2014); enforcement of OHS Regulation in Nigeria (Umeokafor *et al*., 2014); and evaluation of accidents and safety in the Nigerian construction industry (Aniekwu, 2017).Similarly, researches were alsoconducted on accident cost (direct and indirect costs) which is focused more on the construction stage of a project. According to Kheni *et al.* (2010), literatures on H&S in developing countries have identified safety measures implementation as one of the lapses. The rate of accidents leading to injuries, ill health and deaths due to construction activities are alarming and there is the need to take a critical look at this so as to develop a model to manage H&S measures implementation on construction SMEs.In the light of this, the Nigerian studies have not focused attention on developing a model that will be capable of enhancing the level of implementation of safety measures for improved safety performance of SMEs .Moreover, a significant difference is observed in construction safety performance between large and small contractors. Therefore, only the large firms have a safety policy, conduct safety training and appoint safety staff on their worksites (Faul *et al.*, 2009; Raheem and Hinze, 2013; Raheem and Issa, 2016).

It has been established from the above background that Nigerian construction SMEs lack a model for improving safety measures implementation. This is the gap to be filled by this research. Findings from this study will help construction firms to improve in their safety culture.The developed model would ensure implementation of safety measures to achieve project performance, the study would also provide the government and the construction SMEs with a model for enhancing its safety regulations and legislation for project performance in the Nigerian construction SMEs.

1.7 Scope of the Study

The study covered data relating to safety measures required on site, current state of safety measures implementation, barriers influencing the implementation, effects of the safety measures implementation on the cost of accidents and compensation to injured workers on construction sites in Abuja, Nigeria. The rate of accidents and amount of compensation paid to victims were obtained from selected construction firms. Thestudy focused onsmall and medium size construction firms (construction SMEs) some of which are ISO certified and operate in Abuja this is because a greater percentage of the construction firms operating in AbujaNigeria falls within the category of SMEswhich in turn result into high rate of construction accidents in Abuja. In this study, Health and Safety officers (HSO), H&S representatives, safety experts, managers were contacted to provide the required information on SMEs.The choice of Abuja for this study is because it is the nation's capital and is witnessing an outstanding increase in construction activities in the past decade, having an unprecedentedexpansion into new towns due to population influx into the city.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 The Construction Industry

The construction industry is been regarded by some economists as a leading driver of economic development in a country. This is basically because virtually all other economic sectors are completely dependent on the products and services offered by the construction industry to carry out their activities. For example, it would be impossible for the manufacturing industry to thrive without appropriate buildings and infrastructure such as office buildings, and all other products of the construction industry (Kawuwa *et al.*,2018).The construction industry is known for its hazardous activities; its accident record is on the increase which make it the highest across other industries (ILO, 2018). For instance, the preliminary data from the Health and Safety Executive (HSE) (2018) for 2017/2018 shows that the construction industry in Britain recorded 38 fatal injuries in 2017/2018, which was greater than for any other industry (HSE, 2018).

The construction industry had the greatest rate of casualties globally, compared to other industries. (Amiri *et al*., 2017). According to Abas*et al.* (2020), the construction industry plays a significant part in the development process by contributing to economic expansion, which in turn generates extra demand for construction services. Despite contributing significantly to the country's economic prosperity, the construction industry has also contributed to high fatality rates due to a high number of accidents. Thus, safety becomes one of the significant concerns in the construction sector.

ILO(2012) posited that high rate of accidents occurs in the construction industry than in other manufacturing sectors. Possibly because the construction industry is an amalgamation of itinerant workers, many of who are not conversant with the construction processes, others are self-employed; but ultimately, a large number of them are seasonally employed. In addition, Workers participate in a wide range of trades and activities and are subjected to adverse weather conditions. However, according to a guideline released by the ILO (2012) in Geneva stated that construction work in concern should be made safe and all existing conditions on site should mitigate threats and dangers to life and should enhance professional skills.ILO (2012)reported further that an employer needs to have safety norms and standards; there should be safety practices on construction sites to be followed by the employer. Effective safety management should establish a safe working environment, a job that is free of hazards, and raise worker awareness. In recent years, many industrialized countries have viewed safety as one of the most significant project management challenges, particularly personal safety (Yoon *et al*., 2019).

In line with the foregoing, it has been stated that low safety concerns on construction sites have a physical and psychological impact on workers and their families, which has a financial impact on the project by increasing direct and indirect costs (Bansal, 2011). As a result, the industry's H&S performance remains a significant concern

In many countries' development initiatives, including Nigeria's. Workplace H&S is a global problem to our societies and civilisations long-term growth. According to the ILO (2012), work-related injuries and illnesses account for 3.9 percent of all deaths, with 25% of the global population experiencing a minor or major occupational injury or disease in any given year. Aside from moral problems, the financial cost is enormous. Workplace injuries cost the United States 125.1 billion dollars (1.5 percent of GDP) in 1998, and the United Kingdom between 14.5 and 18 billion pounds (2.1 percent to 2.6

percent of GDP) each year (Okojie, 2010). This jeopardizes the industry's efforts to build and develop in a sustainable manner.

However, the legal responsibility is a requirement or set of duties for which a person’s act towards others and the public would be prosecuted. If a contractor’s action do not meet this standard of care, the Acts are considered claimed in a lawsuit for negligence. The construction industry has long been connected with major issues such as top management's lack of safety knowledge, lack of training, low contractors’ safety awareness, management and worker attitudes, and a reluctance to allocate funding for safety. As a result, serious accidents at the construction sites are generated (Mustapha *et al*., 2018). The construction industry has long been connected with major issues such as top management's lack of safety knowledge, lack of training, low contractors’ safety awareness, management and worker attitudes, and a reluctance to allocate funding for safety. As a result, serious accidents at the construction sites are generated, which will harm others.

According to Dodo (2014), contractors' safety management practices are of great concern, including the lack of personal protective equipment, frequent safety meetings, and safety training. As a result, the most significant repercussions of construction site accidents on construction industry include excessive costs, schedule disruptions, a negative reputation for the organisation, and a burden on the workers and others.Therefore, by completely identifying the elements that influence the implementation of safety measures on resources such as workers equipment, and materials, as well as exercising good safety management, the construction safety risk on site can be reduced. This may result in improved project safety and overall project success.

2.2 Overview of Nigerian Construction Industry

Developing countries have a poor record in terms of H&S (Manu *et al.*, 2018). For example, Okoye (2018) reported on a study of 236 construction workers from various trades in one of Nigeria's 36 states, Anambra, which found that carpenters, masons, iron benders, and steel fixers all have very high-risk levels of 13.7, 13, and 12.3, respectively. This was measured against the risk scale recommended by the Code of Practice on Workplace Safety and Health Risk Management (Manu *et al.*, 2018). The data presented is representative of the situation in Nigeria, as most accidents go unreported (ILO, 2017).

In spite of the socio-economic significance of the construction sector, it has an enviable reputation in terms of OHS. In Nigeria, approximately 25% of the Nigeria's workforce were attributed to construction industry (Tochi *et al.*, 2021). Construction industry is also viewed as labour intensive and it constitutes labour cost which amounts to 40-65% of the overall cost of a project (Rao *et al.*, 2015). Therefore, the labour intensive nature of the industry will demands more human involvement at the production stage. The variety of activities necessary in the building production process, according to Muiruri and Mulinge (2014), pose different difficulties to workers' health inherent dangers in the production stage... Hundreds of construction workers are also claimed to be murdered each year on Nigerian construction sites, with many more made severely or permanently crippled (Yakubu, 2017).

The Nigerian construction industry has maintained its importance in the country's economy. The construction sector contributed approximately ₦121, 900.86million Naira to Gross Fixed Capital Formation in 2012, and employed 6,913,536 people (excluding casual workers) National Bureau of Statistics, (NBS) (2015). In 2014, it accounted for 3.82 percent of total GDP (NBS, 2015).Various studies have acknowledged the considerable contribution of the Nigerian construction industry to the Nigerian economy (Diugwu *et al*., 2013; Umeokafor *et al.,* 2014; Windapo and Jegede 2013) and the industry's dismal situation in terms of H&S is also highlighted (Dodo, 2014; Idoro, 2011; Windapo and Jegede, 2013).In particular, Idoro (20011) observed that the injury per accident rate of multinational contractors was relatively high, ranging from 0.13 to 4.0 percent, with a mean of 0.94. Idoro (2011) similarly observed a 0.19–3.0 injury per accident rate mean of 0.77 for indigenous contractors.

Despite thelimited reliable data relating to construction accidents in Nigeria, previous studies have shown that accidents and injury rate are quite high as compared to other industries in the country (Agwu and Olede, 2014; Aniekwu, 2017; Kalejaiye, 2013; Olutuase, 2014; Dodo, 2014). This obnoxious trend frequently results in site closures, loss of man-hours, compensation payments, and reputational damage, all of which have an impact on the industry's performance and contribution to national growth. Although, Nigeria’s construction industry is expanding at a rapid pace, efforts to improve safety performance have yielded only slight improvement. It is, nevertheless, depressing that, despite several efforts to improve the H&S status of the Nigerian construction industry, the number of accidents (both recorded and unreported) on construction sites continues to rise.

2.2.1 Occupational health and safety in the Nigerian construction industry

Occupational Health and Safety (OHS) is well known in the construction industry as one of the most important subjects by its very dynamic nature. The implementation of OHS measures in the industry is critical for the protection of all project stakeholders

(Lingard*et al.*, 2015).OHS has been defined by the ILO(2012) as: "The prevention and maintenance of the highest degree of physical, mental and social well-being, the prevention of ill-health among workers caused by their working conditions, the protection of employees against workplace hazards that could be harmful to their health, as well as the establishment and maintenance of work environments that were already individualized for each employee and psychological conditions."

Over the years, the construction industry has recorded one of the pitiable OHS records as compared to the other industries (Rouhanizadeh and Kermanshachi, 2021; Sherratt, *et al.,* 2015; Choe and Leite, 2017). The high number of accidents (death, permanent disability and non-permanent disability) reported has been explained by the natural characteristics of construction work environment (Choe and Leite, 2017). Despite the persistent endeavours that have been made to improve and promote construction safety (Sherratt, *et al.,* 2015) those accidents still plague the industry (Zhou *et al.,* 2015).According to Arewa and Farrell (2012), Construction SMEs in construction accounts for 90% of the fatalities at work. Evidence has also shown that construction SMEs are the major contributor to the high incidence of serious injuries and fatalities (Zhou, *et al.,* 2015).

Furthermore, there is evidence that accident rate is higher in small construction businesses than in larger ones (Kheni *et al.,* 2010). As most SMEs are ranked at the lower end of the inter-organisational hierarchy such as the sub-contractor of a project, the ability for SMEs to exert influences on decision-making in the construction process is limited, despite their workers' day-to-day exposure to OHS risks (Robina-Ramírez, *et al.,* 2021). Also, due to a lack of resources and awareness of the OHS risks at work, construction SMEs often are unaware of their responsibilities for OHS, which contributes to poor safety practices. (Rouhanizadeh and Kermanshachi 2021). The effects of poor safety practices could have a detrimental impact on the objective of safety management in terms of establishing a safe workplace.

The importance nature of OHS practices within the construction industry has long been recognised in both developed and developing countries. Manu*et al.* (2018), in a study on OHS practices in developing countries, revealed that in most developing countries the practice of OHS management is not commonly implemented and could only worsen if no appropriate actions and preventive measures were taken. According to the Department of Occupational Safety and Health (DOSH) (2017), out of 237 occupational accidents reported in construction in the year 2015, 88 were fatal with a fatality rate of 4.84 per 100,000 workers. The number of fatalities increased about 3 per cent, equivalent to 91 fatalities in the following year. 52 cases of deaths at construction sites have been reported in the first six months of 2018, according to recent statistics, compared to a lower number of 40 deaths for the same period in 2017 (DOSH, 2017).

Despite the previous studies conducted in Nigeria for instance (Dodo, 2014; Idoro, 2011; Umeokafor *et al.*, 2014), OHS has almost exclusively focused on safety practices in large construction industry, while little has been undertaken on examining the extent of construction SMEs and OHS practices (Aziz*et al.*, 2015). Rouhanizadeh and Kermanshachi (2021) further emphasised that OHS in SMEs is still lacking despite their substantial contribution to workplace accident statistics. The failures in OHS compliance were due to the inability to fully understand the construction process and requirements, lack of financial capability, lack of OHS and risk management knowledge (Ayob*et al.*, 2018). Thus, more knowledge is needed regarding to OHS practices. Construction SMEs is vulnerable to adverse H&S accidents as it can negatively affect the image and future job demands for the construction industry.

OHS in construction work should start at the designing table and continue throughout the construction phases until the safety and health of end users is ensured due to the complexity of the industry and the hazards it contains. Kayumba (2013);Diugwu *et al., (*2012); Okolie and Okoye (2012), Idubor and Oisamoje (2013) and Umeokafor *et al.,* (2014) identified low levels of safety practices as seen by the frequency and severity of accidents recorded and reported on Nigerian construction sites.Occupational safety is an integral part of construction operation due to the uniqueness of the industry, different trades and skills are needed to be carried in a safe environment, however individual's contributions determine the successful outcome of the projects (Dodo, 2014). This fact is buttressed as H&S policy is one of the parameters in prequalifying suitable contractors for the award of construction projects in Nigeria (Windapo and Jegede, 2013).

Kolo (2015) reports that even the Nigerian contractors with the highest safety records still record a substantially high number of injuries on their sites. Diugwu *et al.* (2012) asserted that these figures are often even worse in practice as a result of an inappropriatereports and concealment. Similar studies have also revealed a significant rate of non-compliance for safety regulations requiring companies to report accidents (Diugwu *et al.,* 2012). Although there are laws governing work and work environments in Nigeria, such as the Factories Act of 1990 and the Employee's Compensation Act of 2011, some have claimed that these laws and regulations are indeed the reason of the country's low safety performance (Diugwu *et al*., 2012).Compliance to and enforcement of OHS legislations have generally been depicted as poor (Idubor and

Oisamoje, 2013; Okojie, 2010). Idoro (2008) also linked the country’s poor H&S status to lack of concern, lack of accurate records and poor statutory regulations. Furthermore, these studies have generally highlighted the limited scope of H&S management by organisations which could be contributing to the poor H&S performance.

2.3 Safety Culture in the Construction Industry

Over the past few years much attention has been paid to safety culture. However, there is no consensus definition on Safety culture, as different authors define Safety culture to suit their particular situation. Safety culture, according to Agwu and Olede (2014), is a combination of ideas, norms, attitudes, roles, social, and technical practices aimed at reducing the risk of employees, managers, customers, and members of the public being exposed to potentially unsafe or injurious situations. It is assumed that incorporating a positive safety culture into the Nigerian construction industry's investment in machinery and technology (socio-technical investments) will result in improved safety performance of personnel (lower rate of dangerous acts) and the sector as a whole (reduced rate of fatalities). Overall safety culture can be defined as a combination of ideas, norms, attitudes, and social technical practices aimed at reducing the risk of individuals within and outside an organisation being exposed to hazardous or injurious situations.

A construction industry's safety culture is inextricably tied to the attitudes of its workers toward safety. They assess the risks and accidents that the industry faces. The importance of management's role in safety and health culture, as well as all employees' participation as major players, is critical in cultivating positive beliefs, practices, norms, and attitudes among all employees. Agwu and Olede (2014) identified three crucial safety culture indicators. They are:

i. Effective communication leads to common goals and means of achieving them.
ii. External influences, such as the organization's financial health, the current economic climate, and the impact of legislation, as well as how well these are regulated.
iii. Organisational H&S focus, or how much time and attention is devoted to H&S.

2.4 The Concept of Small and Medium-Sized Construction Firms

There has been no commonly accepted definition of SMEs (Napoleon, 2016). Definitions vary from one country or industrial sector to another. Researchers and governments employ various definitions to suit their purposes. Definitions are generally based on different criteria (both Quantitative and Qualitative). Quantitative definitions adopt employee numbers, turnover, value of fixed assets, and balance sheet total whilst qualitative definitions adopt ownership, responsibility, flexibility, level of autonomy and market share. In a similar vein, Ogechukwu *et al.* (2013) reported that in Nigeria and worldwide, there seems to be no specific definition of small business. Different scholars and authors have different concepts as to the differences in capital expenditure, total number of employees, turnover, fixed capital investment, plant and machinery available, market share and the level of development. These features also vary from one nation to the other.Ogechukwu *et al.* (2013) provided three central qualitative criteria by which small firms differ from large ones as follows:

i. Uncertainty of small firms being price-takers;
ii. Innovation by providing marginally differentiated or non-standardized varieties of products or services; and
iii. Evolution through experiencing greater range of changes than occurs in larger firms, it was against this background that the European Commission (EC) coined the term Small and Medium Enterprises (SMEs).

The European Commission (EC) adopts both quantitative and qualitative criteria in its definitions namely; number of employees, the size of the business in financial terms, and its independence (as indicated in Table 2.1). An independent business in this context means one that is less than 25 per cent owned by one enterprise (or jointly by several enterprises).However, the EC's definition is too all-embracing for a number of countries. Researchers would have to use definitions for small firms which are more appropriate to their particular 'target 'group (an operational definition). It must be emphasized that debates on definitions can turn out to be sterile unless size is a factor which influences performance.

Table 2.1: European Commission's Definition of SMEs

Criteria	Micro	Small	Medium
Employees	Maximum 10	Maximum 50	Maximum 250
Maximum turnover (10 million EUR)	-	7	40
Maximum balance sheet total (in million EUR)	-	5	27
Independence	-	25%	25%

Source: European Commission (1996)

In Nigeria, United Kingdom and many other nations, the definition of a small business varies between scholars and government entities. SMEs are broadly defined as business with turnover of less than 100 million per annum and/or less than 300 employees. Similarly, Onugu (2005) provided the following definitions:

i. **Small Enterprises:** An enterprises whose total cost including working capital but excluding land is between ten million naira (₦10,000,000) and one hundred million naira (₦100,000,000) and/or a workforce ranging from eleven (11) to seventy (70) full-time staff and/or with a turnover of not greater than ten million naira (₦10,000,000) annually.

ii.**Medium Enterprises:**A company with total costs of more than one hundred million naira (₦100, 000,000) but less than three hundred million naira (₦300, 000,000.00), including working capital but excluding cost of land and/or a staff strength of between seventy-one (71) and two hundred (200) full-time workers and/or with an annual turnover of not more than twenty million naira (₦20, 000,000.00) only.

iii**. Large Enterprises:** Any enterprises whose total cost including working capital but excluding cost of land is above three hundred-million-naira (₦300,000,000) and/or a labour force of over two hundred (200) workers and/or an annual turnover of more than twenty million naira (₦20,000,000,00) only.

Researchers generally overcome the problem of definition by coming up with their own arbitrary definition to suit their research problem. While this may help answer their research question(s), it could reduce the comparability of results and the validation of the findings of research adopting similar definitions. In view of this, the Small and Medium Enterprises Development Agency of Nigeria's (SMEDAN) (2012) definition of a small firm as an enterprise whose total assets, including working capital but excluding the cost of land, is between ₦5 million and ₦50 million with a workforce of between 11 to 70 full-time staff, and an annual turnover of not more than ₦10 million, may be considered very worthwhile. SMEDAN (2012) defines a medium-scale enterprise as a business with a total asset of more than ₦50 million but less than ₦500 million, which includes working capital but excludes the cost of land and buildings. Moreover, the medium-sized firm has a staff strength of between 71 to 199 full-time workers, with an annual turnover of not more than ₦20 million. In this research, the definitions and classifications of SMEs, as set out by SMEDAN (2012), are adopted as the operational definitions.

About 81% of construction SMEs in Nigeria is small- scale enterprises while about 19% are medium (National Bureau of Statistics (NBS) (2015) and Small and Medium Enterprises Development Agency of Nigeria (SMEDAN) (2012). A vast majority of the Nigerian construction SMEs are sole proprietorship business enterprises; that is about 92% of the Nigerian construction SMEs are sole proprietorship mode. The highest number of the owners/managers of the Nigerian construction SMEs is of ages between 36 and 50 years and this constitutes about 42% of the total population of the Nigerian construction SMEs.

The Nigerian construction SMEs have a great contribution to the Nigerian economy in terms of the building and construction investment; that is the Nigerian construction SMEs contribute to about 11% of the Nigeria's GDP in 2010 (NBS, 2015) and (SMEDAN,2012).Therefore, this research adopted the definition of SMEs in line with SMEDAN (2012) and (NBS, 2015). Almost 17.2 million small and medium-sized enterprises approximately 96% of all businesses operating in Nigeria, contributes at least 75% of the country's employment (Ilori, 2017). Due to their perceived inability to complete projects of greater complexity and profitability, construction SMES are often not considered by all categories of clients in the construction sector for fear of their abilities to meet these parameters. It is the usual practice that 'white elephant projects' are awarded to large construction firms that are mostly owned by foreign investors (Mitrofanova *et al*., 2015). This scenario has not enabled the potential of small and medium-sized construction firms to be explored in terms of global competitiveness. Besides, there is still a lack of empirical evidence on the possible correlation of

Construction firm size to project performance that could enable the apportionment of performance criticism of the construction industry to small and medium-sized firms (Ilori, 2017).

2.4.1 Characteristics of SMEs

Construction firms can be distinguished from each other, through various means such as, the size of annual turnover, number of employees, plants and equipment holding, capacity and capability standards. However small-scale construction firms in Nigeria rare employ more than 25 workers with virtually no construction plant and equipment, while their productivity and performance remain relatively low due to cost and time overruns, coupled with poor workmanship (Musonda*et al.*, 2018).Onugu (2005) claims that SMEs have an ownership structure that primarily centres on a key man or family. Majority of the SMEs is either sole proprietorships or partnerships. Even where the registration status is that of a limited company, the true ownership structure is that of a one-man, family or partnership business (Shittu, 2016).

Odediran *et al*. (2013) identified five (5) organisational characteristics in the study of the business structure of indigenous firms in Nigerian construction industry. These organisational characteristics identified are firms size (which was determined using annual turnover, staff strength and equipment capacity), area of specialisation (which was grouped into building, civil, and industrial/heavy engineering), type of client (which was grouped into public, federal ministries/Parastatals, state ministries/Parastatals local governments, private, individual/institutions, international agencies and non-governmental organisations) business type (which was grouped in to build only, design and build or package deal, design, build and finance and design, build and operate), project funding arrangement(which was grouped into bank loans, retained earnings, share capital and mobilisation) and years of experience of firm.

One of the main differences between large organisations and SMEs is the financial resource capability and availability towards the implementation of OHS management practices (Kheni *et al*., 2010; Surienty, 2012). Large organisations often have strong financial capability that could ensure good implementation of safety management systems, while most SMEs have constrained financial capability that disables the commitment on planning and implementing safety management practices and programmes.

Apart from the economic distinction, SMEs could also be characterised by its nature example (heterogeneous, geographical dispersion, lack of cohesive representation.), organisational factor (for instance non-formal ownership, being independent, simple lines of communication) and industry dynamism example (a limited market share, high resource constraints, limited access to external sources for support). Hasle *et al*. (2012) emphasized that it is challenging to differentiate between safety management practices and other aspects of running small firms (management and operational activities). For example, SMEs prefer to communicate verbally compared to written communication, causing the lack of formal documentation and system (example is the in-house OHS policy and OHS system), limited knowledge of existing OHS Acts, Regulations and Codes of Practices and limited knowledge on hazards controls and health effects (example evaluation of risks to avoid accidents) (Hasle *et al.,* 2012; Manu *et al.,* 2018).

In addition, there is evidence that subcontractors commonly hire unskilled workers who have difficulty to go through OHS learning and training due to linguistic and cognitive inability to understand good safety practices (Gao *et al.,* 2017). The difficulties faced by SMEs due to payment issues from principal contractors also influence their ability to focus on OHS (Lingard *et al.,* 2015). Several scholars such as (Loosemore and Andonakis, 2007; Sunindijo, 2015) have suggested that the lack of collective support (union representation) from the industry also weakens the effort to govern safety within the community. Overall, these characteristics could further aggravate the ability of construction SMEs to deliver systematic safety management practices in the workplace. Qualitative definitions of SMEs are based on the characteristics SMEs possess which differentiate them from larger businesses.

2.5 Construction Accidents

According to the HSE (2006) and Hughes and Ferret (2016), an accident is "an unforeseen incident that results in personal injury or illness, or property, plant, material, or environmental damage or loss, or a loss of a commercial opportunity." It was also said that in the construction industry, there are various forms of accidents. Hughes and Ferret (2016) categorised construction accidents as fatal (major injury) or non-fatal (minor injury), and they stated that both types of accidents are foreseeable and avoidable. Accident prevention and investigation have become crucial as a result of the enormous damage that it inflicts on both victims and construction industry, especially the SMEs. Because of the immense harm that accidents cause to both victims and the construction industry, particularly SMEs, accident prevention and investigation have become critical, according to (Ardeshir and Mohajeri, 2018). It is therefore necessary to understand what causes these accidents in the construction industry.

2.5.1 Classification of accidents

Accident can be classified based on the extent of harmor damage done to the victim. Thus, there are fatal accident, major accident and minor accident (Ardeshir and Mohajeri, 2018):

i. **Fatal accident:** An accident is said to be fatal if it resulted in death of the victim.

ii. **Major Accident:** Major accident includes accident which causes suffering from any of the following injuries or conditions in connection with the work. Fracture of the skull or pelvic fracture, ankle amputation or the hand, foot, finger or thumb or of the bones in the arm, wrist, and leg, kneel to toe, Loss of consciousness resulting from lack of oxygen or struck by objects, acute illness requiring treatment resulting from absorption of any substance (ILO, 2012).

iii. **Minor Accident:** This refers to any accidental injury which does not cause any harm up to the extent of hospitalizing the victim or the victim losing working days.

ILO (2012) identified nine main categories of events capable of causing injury on site. These are described as following:

a. Stepping on, striking against or struck by object including falling objects.
b. Caught in or between objects.
c. Over exertion or strenuous movement.
d. Exposure to or contact with electric current.
e. Exposure to or contact with extreme temperature.
f. Fall of person.
g. Struck by falling object.
h. Other types of accident.

2.5.2 Causes of accident on construction sites

HSE (2006); Ikpe (2009); and Hughes andFerret (2016) identified the causes of accident as the result of unsafe activities and conditions. Hughes and Ferret (2016) further attributed the unsafe conditions to four main causes; management action or inaction, unsafe acts of workers or co-workers, events not directly human related and unsafe conditions. The unsafe acts, unsafe conditions and management related factors are shown in Table 2.2.

Table 2.2: Causes of Accident on Construction Sites

Unsafe acts	**Unsafe condition**	**Management related causes**
Using an equipment in a wrong way	Inadequate or missing guard	Inadequate planning
Failure to warn others of danger	Missing platform guardrails	Inadequate design
Leaving equipment in a dangerous condition	Defective tools and equipment	Lack of training and awareness
Failure to use or wear PPE	Acts of violence and noise	Inadequate supervision
Use of defective equipment	Inadequate fire warning system	Ineffective policy of the management
Contact with moving vehicle	Contact with electricity	Failure to comply with operating instruction
Struck by moving including flying/falling object	Hazardous atmospheric conditions	
Manual handling	Fire hazards	
Strike against something fixed or stationary	Exposure to an explosion	
Failure to lift loads correctly	Not enough light to see to do work	
Taking drugs or alcohol on construction site	Excessive noise	
Slip trip or fall on same level	Dust	
Working without authority	Contact with harmful substances	
Fall from a height		

Source: (Ikpe 2009; Hughes and Ferret, 2016)

According to ILO (2012), there are at least 60,000 fatal accidents occur annually on construction sites around the world with one fatal accident every ten minutes, approximately 270 million workers suffer occupational accidents yearly that leads to absence from work for 3 days or more, and approximately 4% of the world's GDP is lost with the cost of injury, death and disease through absence from work, sickness treatment, disability and survivor benefits (Belayutham and Ibrahim, 2019). However, accidents have considerable negative effects on project execution; some of these effects are damages to materials and equipment, injuries to labour, delay of works, reduced productivity, resource wastage and increased construction cost (Hughes and Ferret, 2016).

In a similar vein,Mensah *et al.*(2020) also noted that accident in the construction industry has huge financial constraints on the employer which will be used in reorganizing of wok; replacement of materials, plants, compensation and legal cost. According toKheni *et al.*, (2010) effects of accidents in the construction industry therefore fall into three major categories as thus:

a. Humanitarian

This refersto the effects as concerned worker on the site and these include: Suffering to individual; Fatality; Minor injury; Disabling injury; and possible loss of earning ability.

b. Economic

According to Mensah *et al.* (2020), the cost of supervision is the cost of averting an accident, which is accountable for site efficiency and safety. Furthermore, the cost of insurance is a significant sum of money that does not end there; it also includes additional charges that bite into the project's profit margin. According to Kheni *et al*. (2010), economic effects of accidents in construction industry include:Production delay; Increment in insurance premium; Legal expenses; Time loss by the employee;

reduced quality; Time spent in training a temporary or permanent replacement; and Time spent by management and supervision in investigating and reporting the accident.

c. Legal

Mensah *et al.* (2020) reported that negligence in law call for replacement, employers and liable for injury of the workers during the process of carrying out duties. All claims for damages under bodily injury made in the name of negligence. Vicarious liability means the act done through another person. The employer is as well liable for the act of negligence committed by his employee. The legal effect of accident includes: Legal liability; and Failure to safeguard employee being a criminal offence leading to prosecution.

2.6 Health and Safety Regulations

According to research, the origins of H&S legislation may be traced back to the United Kingdom and the United States (Fellows *et al.,* 2004). Nigeria, being a former British colony, was completely reliant on the colonial master's norms and laws before and after independence. As a result, practically all extant H&S reference regulations in Nigeria are from other nations (Idoro, 2008). Construction regulations, according to Bansal (2011) are statutory instruments that set out the minimum legal requirements for construction works and are primarily concerned with the health, safety, and welfare of the workforce, which must be considered when planning construction operations and during the construction period. According to Musonda *et al.* (2018) and Idubor and Oisamoje (2013) regulations will not be effective without proper enforcement.

Construction and other work-related industries are governed by H&S rules around the globe. There are a number of occupational health and safety laws in Nigeria as well. These include the Labour Act of 1974, which was modified to Labour Acts 1990 and updated to Labour Act, Cap L1, Laws of the Federation of Nigeria (LFN), 2004; the Factories Act of 1987, which went into effect in 1990 and was later updated to Factories Act, Cap. F1, LFN, 2004, Federal Government of Nigeria, "The Factory Act Of 1990"; and the Workman's Compensation Act of 1987, which went into effect in 1990 and was later repealed to Employee's Compensation Act,, No. 13, 2010 of the laws of the Federal Republic of Nigeria, "Factories Act 126 Cap. F1 LFN', Federation of Nigeria (2010) the Insurance Act, 2003 and the Labour, Safety, Health and Welfare Bill of 2012 including the National Building Code(2016) enforcement Bill which has suffered huge political setback over the years, and is yet to be passed into law by the National Assembly.

The Federal Ministry of Labour and Employment is in charge of enforcing the Factories Act and the Employees Compensation Act, while the Labour, Safety, Health, and Welfare Bill of 2012 provides the National Council for OHS of Nigeria the authority to administer the regulations on its behalf, Musonda *et al.*(2018). These regulations are highly developed and functional in industrialised countries such as the United Kingdom, the United States, Australia, Singapore, and Germany. Despite being one of the countries that signed the Geneva Convention on OHS in 1981, Nigeria's construction industry continues to have a poor H&S record. H&S regulations governing the construction industry and other work-related industries exist in Nigeria. A number of legislations on health and safety exist. These include:

i. Labour Act of 1974 modified to Labour Acts 1990, and updated to Labour Act, Cap L1, Laws of the Federation of Nigeria (LFN), 2004
ii. The Factories Act of 1987 which became effective in 1990 and later updated to Factories Act, Cap. F1, LFN, 2004. The existing H&S legislation is the Factories

Act, Cap.F1 LFN 2004. Kalejaiye (2013) asserted this Acts as the landmark of H&S legislation in Nigeria as it properly defines the small scale enterprises. However, the Act is riddled with some limitations for example the factories Act LFN 2004 in Section 7-10 and 12 centered on sanitary, overcrowding, ventilation and lighting requirement in the workplace.

iii. The Workman's Compensation Act of 1987 which became effective in 1990, modified to Workman's Compensation Act, Cap W6, LFN, 2004 and repeal to Employee's Compensation Act, No. 13, 2010 of the laws of the Federation of Nigeria. This provides social security for workers and their relatives (Kalejaiye 2013). It repeals the workman's compensation Act 2009 LFN 2004 to all employees and employers in Nigeria, including the construction industry, the ECA is to ensure suitable compensation for deaths, injuries, diseases and disabilities sustained due to employment in the workplace and related matters. The Act specifies the reporting of accidents during or after the work activities, injuries to employees to the National Social Insurance Trust Management Board (NSITFMB) within seven days but death due to employment should be reported immediately (Section 5;Subsection1 and 2). However, in the Act, there are no practical provisions to address the history of underreporting of accidents in the country, hence its efficacy is questionable.

iv. Labour, Safety, Health and Welfare Bill including the National Building Code (2016) Enforcement Bill which has suffered huge political setback over the years.

The anomalies in the factories Act of 2004, the inadequate regulatory system and other factors prompted the signing of the labour, safety, Health and welfare Bill, 2012. But it still awaits presidential assent as at the time of writing this research and the National building code (2016) which is meant to serve as the minimum standard for the building industgry in terms of, among many, safety from the pre-design to post-construction stages is also yet to be passed into law. This aforesaid bill is designed to serve as a comprehensive H&S provision for the workplaces in Nigeria (except industries that covered international treaties and standards) making up the anomalies of the factories Act 2004.

In spite of numerous statutory provisions and expectations in Nigeria, gap still exist in health and safety. This problem is linked to adopting almost all existing regulations of reference on H&S in Nigeria from foreign countries, especially from the British legal system with little or no changes made.Kolo (2015) observed that some provisions from these laws do not necessarily meet the conditions experienced in Nigeria.Adeogun and Okafor (2013) contend that these acts are not being enforced in Nigeria as evidenced from the reports of unhealthy exposure to risks of workers and employees in various organisations.

According to Okeola (2009), the Ministry charged with enforcement of these laws has not been effective in identifying violators probably due to inadequate funding, lack of basic resources and training therefore, consequently neglect safety oversight of other enterprises, particularly construction sites and non-factory works. Umeokafor *et al*.(2014) agreed that the impact of the enforcement authority is ineffective, as the key stakeholders pay less attention to OHS regulations; thus, rendering the OHS scheme dysfunctional and unenforceable, at the same time impeding OHS development. To this end, Diugwu*et al.* (2012) attributed the failed OHS management system to the non-functional OHS regulations and provisions.

Adebiyi (2019) linked the problem to adopting almost all existing regulations of reference on H&S in Nigeria from foreign countries, especially from the British legal system with little or no changes made. Kolo (2015) made the further observation that some of these laws' provisions might not be appropriate for the conditions in Nigeria. However, the labour law does not grant employees the freedom to flee dangerous workplace environments without losing their jobs. Nevertheless, the emergence of new regulations, laws, standards and codes has made many construction organisations to improve their safety performance.

2.6.1 Enforcement mechanisms of health and safety regulations

Muiruri and Mulinge (2014) described enforcement mechanisms as part of H&S management. An organisational framework must be set up to facilitate the implementation of the policy. It is important to set up a structure that outlines the roles and responsibilities of the various levels in terms of safety. It should ensure that safety is integrated into production rather than being separated from it, thereby facilitating total commitment to safety. H&S organisation on a site includes the following: Safety officer, supervisor/Foreman, worker, safety Committee, safety Representatives and Government representative. According to Idubor and Oisamoje (2013), lack of strict enforcement of OHS regulations enables non- compliance to OHS regulations; while Umeokafor *et al. (*2014) state that non-compliance to OSH regulations is a major contributor to the poor state of OHS in Nigeria. Hence compliance with OHS legislations can increase productivity in industries by reducing accidents, because accidents result in decreasing productivity and damage to equipment or property (Idubor and Oisamoje, 2013).

On the other hand, H&S measures are said not to be effective in improving H&S conditions in workplace. OHS regulations, according to Kamau (2014), are ineffective and only serve as symbolic gestures. Therefore, an extensive research of the level of

H&S knowledge and compliance of construction workers is required considering the high rate of H&S abuses on construction sites among construction stakeholders. This is because enforcement and compliance with OHS regulations are not the standalone steps for improving OHS, as improving organisational culture can also improve OHS (Umeokafor*et al.*, 2014). This therefore, implies that regulation without strict compliance and management commitments amounts to waste of time and resource.

2.6.2 Safety code of practice inthe construction industry

The purpose of building codes and construction regulations cannot be over emphasized in project development and management, they ensure H&S of workers, it provide habitable facilities, promotion of energy efficiency, it also facilitates sustainable development and contribute greatly to meeting the demands construction stakeholders. Muiruri and Mulinge (2014) asserted that code and regulations is not stand alone to improve construction safety at reduce cost, rather poor codes and regulations can only add to project cost without any solution to construction safety compliance. The cost arises from delays in construction progress include both direct and indirect cost on the employers and employees.

The numerous numbers of codes and regulations that support management of health and safety practice includes: The provision and use of Equipment Regulation (1992), ILO code of practice - ILO (2012), the manual handling Operations regulations (1992), The Personal protective equipment(PPE) at work regulations (1992), the OHS Act of (2007), the H&S (Display Screen Equipment) Regulations (1991), H&S (First-Aid) regulations (1981), management of H&S at work regulations (1999), control of substances hazardous to health regulations (2002) and the National Building Code (2016) (Bamisile, 2004; Muiruri and Mulinge , 2014).

2.7 Effective Health and Safety MeasuresRequired for Construction SMEs' Improved Performance

Construction industry is considered one of the most hazardous industries because of its unique nature (Fang and Wu, 2013).It comprises of a wide range of activities (both construction and repair) that rely intensively on labourers, heavy machinery and equipment Construction workers frequently engage in tasks that might put them in danger, such as falling from rooftops, coming into contact with unguarded machinery, and getting pulled over by heavy machinery (Popov*et al.*, 2016). Therefore, safety procedures related to the construction industry or project sites have been established in different countries (Muiruri and Mulinge, 2014), to ensure that SMEs engaged in the construction industry are also not exposing people in the community or project site workers in immediate danger.

2.7.1 Use of personal protective equipment (PPE)

Personal Protective Equipment are all equipment which is envisioned to be held or worn by a worker at work and which protects him against one or more risks to his health or safety, example include: safety helmets, gloves, eye protection, high-visibility clothing, safety footwear and safety harnesses. The provision of PPE can be argued to be the most significant element in terms of costs of accident prevention and prevention of accidents on construction sites (Ammad *et al.*, 2021). Therefore, adequate provision of these equipment's can help contribute to prevention of accidents on construction sites.

a. Safety Helmet

Safety helmet is the safety equipment that protects the head. The helmet can provide protection from hard objects, glasses and objects falling from high places. Safety helmets must be worn by workers while carrying out works in the construction site. Employer (contractor) must provide a safety helmet to all employees involved to ensure their safety in the site as well (Ammad *et al*., 2021).

b. Safety Boot

Safety boots is used to protect the feet from injuries due to accidental steps on sharp objects and to facilitate movement in construction sites (Ammad *et al.,* 2012).

c. Safety Gloves

Safety gloves is used to protect hands from abrasion, piercing of sharp objects, cold and heat, chemicals, fire and other types of hazards. There are many types of materials used to make safety gloves and there are animal's skin, butyl rubber, Viton rubber, polyethylene, aramids, cotton, chain link, stainless steel cord (wrapped in synthetic fiber) and so on (Ahmad *et al.,* 2012).

d. Eye Protection Equipment

According to Ahmad *et al.* (2016) there are two types of eyes protection equipment and there are the safety goggles and the face protection equipment. Protective equipment is used to protect eyes and face from the work that produces dirty dust, flying particles, exposure to chemicals that could cause inflammation and exposure to high intensity light or laser.

e. First-aid Kit

First-aid kits are tools to handle emergency cases when there are minor accidents on site (Acharya and Shrestha, 2021).There are various sizes of first aid kits. However, the contractor must take into account the number of workers on site so that if an accident occurs, the tool can accommodate the total number of injured workers. Contractors should ensure that there are safety committee members who are skilled in the usage of drugs and equipment in first kits to avoid any wastage (Misan *et al.,* 2012).

f. Safety Belt

Safety belts and life belt (lifelines) are used to protect workers from falls and it is used when they are working at high places or while working on the platform (Ammad *et al*., 2021). There are various components of the equipment used with safety belts, such as anchorage strap, lanyard, body harness, grab, and others.

Personal measures rely upon PPE and, only protect the user. Most commonly personal measures are active, meaning that the user is required to utilize something for it to work effectively such as attaching PPE to a fall prevention system.

2.7.2 Proper site layout and planning

According to Syed and Ammal (2021), many accidents have always had an untidy and poorly planned site as their underlying cause. This is the result of material falls and collisions between workers and equipment. Space restrictions are often the greatest limiting factor, especially in urban work sites, and a plan that prioritizes workers' H&S may seem challenging to reconcile with productivity. There are many accidents due to tripping, slipping or falling over materials and equipment which have been left lying around, and stepping on nails which have been left projecting from timber.

2.7.3 Health and safety warning signs

Under the H&S at Work Act (HSWA) of 1974, the Safety Sign Regulation of 1980 mandated that safety signs adhere to a standardized system of colours and shapes. Safety promotion aims to mobilise employees, suppliers and visitors to “think safe, act safe, feel safe and be safe” and then “Take the Steps to Safety” (HSE, 2006). There is a case to be made for the effectiveness of safety marketing, such as the printing of booklets and banners, in preventing accidents. It promotes awareness and is essential in preventing accidents.

2.7.4 Health and safety risk assessment

Health and safety risk assessment is a crucial step in reducing risks and accidents on construction sites (Acharya and Shrestha, 2021). In the context of H&S, common definitions used for risk are that: risk is the likelihood of a substance to cause harm; and risk is a combination of the likelihood of an occurrence of a hazardous event or exposure(s) and the severity of injury or ill health that can be caused by the event or exposure.

The HSE (2018) defined risk assessment as a process that identifies the hazards associated with particular activities/tasks, evaluates the effects of exposure to these hazards and implements the measure needed to control the risk of injury/ill health to as low a level as possible. In addition, risk assessment has been defined as a structured process that identifies both the likelihood, and extent, of adverse consequences arising from a given activity, facility or system (HSE, 2018).According to HSE (2018)employers are expected to evaluate the health and safety risks that workers and others are exposed to on construction sites.

Risk can be managed or reduced through risk assessment, communication, and control. Where five or more persons are employed, the significant findings must be documented. Since managing health and safety in construction differs from managing any other aspect in construction, it is necessary to do a risk assessment to identify the risks and put necessary measures in place to ensure they are kept under control.Identifying and understanding the risks related to the work that needs to be undertaken is one of the most important duties for managers. Once the risks have been identified, risk-reduction strategies may be implemented to reduce the risk. A risk assessment is a collaborative process that includes hazard identification, risk analysis, and risk valuation (Rausand 2013).

Assessing and understanding risk (A) and managing risk (B) are two of the 23 gaps in risk governance that the International Risk Governance Council (IRGC) identified in 2013. While the first cluster deals with challenges in gathering/interpreting information about the risk and determining its severity, the second cluster deals with shortcomings in the planning and execution of risk-reducing strategies (IRGC, 2013).

2.7.5 Safety personnel

According to Eyiah*et al.,* (2019), H&S is impacted on by various participants across the life cycle of a construction project. Decisions made at one stage in the life cycle also affect H&S at another stage further down in the life cycle and key responsibilities at the various stages are to appoint participants that have the necessary competence and capacity in construction H&S relevant to the project risks. Furthermore, H&S performance is influenced by specification and communication of H&S requirements from one participant to the others, and importantly on the effective monitoring of compliance with these expectations.

2.7.5.1 *Site health and safety officer (SHSO)*

The Site Health and Safety Officer (SHSO) advises the project manager on all aspects of health and safety on site. The SHSO also stops work if any operation threatens worker or public health or safety (Ammad *et al.,* 2021). In addition, the SHSO does the following:

i. Manages field operations.
ii. Enforces safety procedures.
iii. Ensures that all necessary H&S equipment is available on site and is functional.

iv. Periodically inspects protective clothing and equipment.

v. Ensures that protective clothing and equipment are properly stored and maintained.

vi. Controls entry and exit on the site.

vii. Coordinates health and safety program activities.

viii. Confirms each team member's suitability for work based on a physician's recommendation.

ix. Monitors the work parties for signs of stress, such as cold exposure, heat stress, and fatigue.

x. Conducts periodic inspections to determine if health and safety regulations are being followed.

xi. Knows emergency procedures, evacuation routes, and the telephone numbers of the ambulance, local hospital, fire department, and police department in the event of an emergency.

xii. Coordinates emergency medical care.

xiii. Ensures that all required equipment is available.

xiv. Assist in the preparation of all Root Cause Investigation Reports/ Preventative Action Plans for any incidents.

2.7.5.2 *Site safety supervisors*

According to Abas *et al.* (2020), the site safety supervisors play an important role in ensuring a safe and healthy job sites as they interact with site-operatives more often than the first level of management or other professionals. The H&S responsibilities of a supervisor are categorized into the following broad heading: training; accident prevention; accident investigation and reporting.

a. Training Responsibilities

The training could range from one-on-one conservation, group discussion to formal training. Irrespective of the medium used, it is important that training is appropriate for the operatives. The supervisor should provide:

i. Orientation on the organization policy and procedures.
ii. Proper use of equipment and handling of materials.
iii. Orientation on hazardous materials involved in the duties assigned.
iv. General housekeeping procedures
v. Emergency procedure

b. Accident Prevention Responsibilities

This is a continuous responsibility all through the construction phase of the project. The following various techniques could be adopted:

i. Operatives should be empowered to identify hazards associated with their work and recommendations on how to minimize/reduce such risk.
ii. Supervisor and operatives should work as a team in developing safe work procedures.
iii. Operatives should be tutored on appropriate use of personal protective equipment and they should also be taught the fundamentals of safe working practices
iv. Despite aforementioned techniques, the supervisor must still monitor closely every activity of operatives to ensure that it is in compliance with required health and safety standards.

c. Accident Investigation and Reporting

Despite all the above-mentioned preventive efforts by the supervisor, accident may still occur. When this happens, the supervisor must investigate the accident with aim of preventing the likely occurrence of the same accident another time. It is important that the investigation is carried out immediately as time can obscure facts, witnesses can forget, unrelated factor can creep in, accident scene can change to obscure what really happened. Once the investigation is conducted, an accident report shall be written. Regardless of the format adopted by the supervisor, the following rules should be ensured:

i. The report should be brief and contain facts of the incidence.
ii. The supervisor must be objective and impartial.
iii. State clearly what operative(s) and equipment were involved.
iv. List any procedure, process or precaution that were not observed as at the time of the accident.
v. List any casual or contributing factor
vi. Make clear and concise recommendation for corrective measures.

2.7.6 Health and safetytraining

Training Regulation 28 under Health and Safety Work Act (HSWA) 1974 provides for a much wider provision of training for persons carrying out construction work (Hughes and Ferret, 2016). All personnel must have sufficient training, technical knowledge or experience to ensure the reduction of risk of injury to others (Henseler *et al.,* 2016). Training provides more directive instruction as to how an act should be performed. It is therefore suggested that training will enable them to recognise, analysis and establish accident prevention and control measures. Thus, training is crucial to the prevention of accidents on construction sites (Ikpe, 2009).

The role of trainings in promoting health and safety has also been highlighted by Shamsuddin *et al.* (2015). Kumar and Bansal (2013) argued that effective safety knowledge among construction professionals can reduce accidents that directly or indirectly reduce project cost, because in developing countries, safety rules usually do not exist, and if exist; regulatory authorities are unable to implement such rules effectively. The above view is supported by (Sunindijo and Zou, 2014).

According to Akinwale and Olusanya (2016), sources of safety knowledge Include accident investigation, teamwork, collaborations and survey of safety culture. Problem solving entails specific decisions on OHS risks in an organisation. Knowledge is more than information, since it involves an awareness or understanding gained through experience, familiarity or learning (Bust, 2014). According to Vitharana and De- silva (2015), one of the major needs with regard to the construction industry is to enhance professionals' interests in active safety management and implementation of awareness programs, which must be developed and implemented among construction workers.

Akinwale and Olusanya (2016) argued that awareness on possible risk factors and knowledge on how to reduce these risk factors among workers and contractors will enhance site safety. Safety knowledge therefore, encompasses awareness of OHS risks, including an evaluation of OHS programmes in an organisation (Akinwale and Olusanya, 2016).

2.7.7 Fencing and accessibility

Fences and the accessibility should be provided in a proper manner. The entire construction area must be fenced to prevent any intrusion by other parties. This will avoid any incidents such as intrusion by children and the public. Proper fence can ensure the safety of equipment and materials in construction site from being stolen. (Muiruri and Mulinge, 2014).

2.7.8 Site meetings

Workers' safety should be prioritized among all activities on construction sites of every construction company. Jones (2011) posited that every site meeting should be carried out to ensure adherence to safety rules and to educate the workforce on safe work practices. Safety meetings are significant in helping to build a strong safety culture, as well as reinforcing the company's commitment to protecting the lives of workers on sites (Jones, 2011).Jones (2011) also suggested that safety meetings are usually the perfect time to make known the new safety policies and procedures that are yet to be implemented as well as safety laws and guidelines that might aid employees in adhering to safety standards.

2.7.9 Good working environment

The term "working environment" is used by the World Health Organization (WHO) (2009) to refer to a collection of biological, medical, physical, psychological, social, and technological factors that have an impact on an individual while they are at work. The design of the work environment affects safety directly through its inherent dangers and indirectly by its effect on the employee performance. ILO (2012) stated that chemical substances are a major health hazards since there are many chemicals used in the construction industry including pesticides, adhesives, disinfectants, wood preservatives, fungicides, and paints, among others, substances constitute a significant health risk. Many of these chemicals have the potential to poison humans and are dangerous.

Long-term exposure to toxic substances can result in both acute and chronic effects. Another serious risk in construction is dust from various sources. Although lead in dust is transported into lungs and enters blood stream, causing poisoning, silica and asbestos dust can chronically harm lung tissue. A well-known source of skin problems is cement mixtures. Electricity cables, pipes, gutters, and lead sheet roofs all contain lead. Constipation results from excessive lead absorption abdominal pain, anaemia, weak muscles and kidney failure.

2.7.10 Welfare facilities

Construction work is laborious and requires a lot of manual labour or physical exertion. It is also risky and dirty, thus having good welfare facilities not only improves employee wellbeing but also increases productivity (Ammad *et al.*, 2021). Welfare services like the provision of drinking water, washing, sanitary, and changing rooms, restrooms and shelter, facilities for preparing and eating meals, temporary housing, and assistance in transport from place of residence to the work site and back, all contribute to reducing fatigue and enhancing workers' health.

Therefore, H&S measures employed on construction sites are inadequate and fail to meet the required standards. The culture and attitude of construction workers and the site supervisors about health and safety often condone risk taking and unsafe work practices. Lack of proper information and ignorance are also to blame for the poor safety measures in construction sites. For instance, some workers felt that the safety equipment's such as hard helmets and reinforced boots are too cumbersome and uncomfortable.

2.8 Health and Safety Implementation Drivers

Cost, time, quality, and H&S are the most important considerations while planning a project. However, cost, time and quality are the most important considerations in project execution, receiving more attention and precedence than H&S (Muiruri and Mulinge, 2014). As a result, there will be a higher risk of an accident occurring.Accidents and their related expenses, according to Smallwood and Haupt (2006), can have a significant impact on a project team's efforts to complete a project on schedule, within quality, and on budget. Furthermore, bad publicity from such catastrophes may harm the reputation of the construction firm and strain relationships among project stakeholders.

H&S, according to Muiruri and Mulinge (2014), is a humanitarian and economic concern that must be addressed in a systematic manner. They further said that this economic concern manifests itself in the form of costs, which are separated into direct (hospitalisation, liability, and property losses) and indirect (delays, training of new workers, etcetera). As a result, H&S implementation is required to decrease the impact of accident expenses. Other reasons for implementing H&S, according to Smallwood (2010), include regulation, financial concerns, fines and penalties, quality, and the construction industry's reputation and image (Muiruri and Mulinge, 2014).In a furtherstudy by Muiruri and Mulinge (2014), construction managers have been demonstrated to believe that when H&S measures are introduced on construction projects, profitability will drop and H&S costs will rise. However, it has been discovered that investing in construction health and safety improves profitability by raising productivity and boosting employee confidence, as well as lowering attrition (Muiruri and Mulinge, 2014).

According to the HSE (2018), investing in the H&S of employees is an investment in success and continuity. As a result, it is critical to do ongoing research on H&S implementation, particularly implementation drivers, to discover what motivates construction companies to take action to prevent incidents, accidents, and fatalities.

2.9 Challenges of Implementation of Safety Measures on Construction SMEs

According to Idubor and Oisamoje, (2013), the challenges of Safety measures implementation of construction SMEs are identified as follows:

2.9.1 Low level of compliance with safety measures regulations

According to Nzuve and Lawrence (2012), the lack of workplace inspection and examination may influence the level of compliance with OHS laws, as evidenced in Nairobi workplaces. In Nigeria, regulatory institutions are characterised by a lack of enforcement (Idubor and Osiamoje, 2013), most laws appear to fulfil all righteousness or are used for political or victimisation reasons, and regulatory institutions are alleged and proven to be corrupt and arbitrarily exercise their powers (Zou and Sunindijo, 2015).

Inspections and determinations of conformity with OHS standards at workplaces are needed by enforcement bodies (Idubor and Oisamoje, 2013). Unfortunately, experienced personnel (OHS officers), the Federal Ministry of Labour and Productivity, and trained safety officers have been identified as weak in strict legislative enforcement. This leads to Nigerian construction industry' non-compliance with OHS requirements (Idubor and Oisamoje, 2013). Although the quality of enforcement may be marginal, Nigerian construction contractors should be required to implement OHS at the organisational level, perhaps through safety officers (Okeola, 2009).According to Kalejaiye (2013), in the absence of proper enforcement of OHS regulations, organisations should adopt self-regulatory style of enforcement, as optimum OHS to improve the images of the organisations, and enable the organizations to maximize profit.

2.9.2 Weak national occupational health and safety standards

OHS, as defined by the WHO, is concerned with all elements of health and safety in the workplace, with a heavy emphasis on primary prevention of dangers to employees. OHS is a multidisciplinary discipline of healthcare that focuses on assisting people in doing their jobs in the healthiest way possible. According to Idubor and Oisamoje (2013), the Nigerian construction industry's inadequate legal structure and lack of law enforcement allows foreign companies to take advantage of inefficient statutory regulation. This could also imply that these foreign firms do not intend to fully comply with Nigerian construction industry safety rules or maintain OHS programme and management system similar to those obtained in their countries of origin, as they intend to reduce expenses and added cost to construction outputs.

2.9.3 Lack of adequate information

According to Acharya and Shrestha (2021), giving all necessary and relevant information is critical to ensuring optimal OHS at work. Provisions for adequate OHS information are necessary, possibly through information technology: in the Nigerian construction industry, mobile phone technological means of reporting accidents and unsafe practices can be adopted for easier record-keeping and up-to-date activities (Okojie, 2010).While the Federal Ministry of Labour is directly responsible for enforcing OHS legislation in the construction industry in Nigeria, not enough information is shared among the Ministry's various entities; as a result, the inspectorate divisions are not well equipped to plan for better enforcement practices. The capacity of multinational construction companies to transfer OHS policies from their home countries into the Nigerian construction industry in order to improve their OHS status is a significant benefit to their business (Ammad *et al.*, 2021). As a result, global corporations such as Shell and Texaco, among others, have been able to improve their safety culture both in Nigeria and internationally.

2.9.4 Bribery and corruption

The World Bank (2016) has identified corruption as among the greatest obstacles to economic and social development. Economists have said that countries with a higher perception of corruption not only deters financial institutions from long term investment but can actually result in capital outflows, creating a volatile economic environment. The construction sector is estimated globally to be worth some US $3,200 billion per year and some US $250 billion is spent annually on infrastructure in the developing world alone (ILO 2018).However, worldwide, the construction sector is known for its overtone with corruption(Ammad *et al.,* 2021).Corruption in the construction industry encompasses new constructions, renovations, and maintenance contracts. Corruption can be found at all levels in the sector, from high-ranking officials diverting cash and foreign firms soliciting bribes for contracts to petty local operators falsifying metre readings or seeking bribes for water connections.

Zou and Sunindijo (2015) highlighted in the transparency International's Global Corruption Report the devastating impact of corruption in construction (such as wasted tender expenses, tendering uncertainty, increased project costs, economic damage, blackmail, criminal prosecutions, fines, blacklisting, brand damage and reputational risk).According to Idubor and Oisamoje (2013), bribery and corruption are the major obstacles to proper adherence to OHS standards in Nigeria. They cited an instance when companies would violate regulations but still receive an "ok" from the inspectors during an inspection because they had been bribed. Corruption poses serious problems for the construction industry as it may occur at any stage of a project. Examples of corrupt practices include bribery, theft, kickbacks, and fraud. In recent years there has been a growing commitment to the anti-corruption agenda in the construction sector.

2.9.5 Management commitment

In Nigeria, a lack of safety consciousness in major construction organisations is frequent, and it must be regarded as a bad example. Tochi *et al*. (2021) further stressed that certain construction firms do not prioritise workers safety. Smallwood and Haupt (2002) agreed that top management should value safety, despite the fact that this lack of value may be due to the view that safety is simply cost related, as discussed. As a result, it reveals that the construction industry does not prioritise employee safety as a priority; rather, it suggests a lack of management commitment to OHS in the Nigerian construction industry.The management must develop and implement H&S policies consciously and effectively. Management should also monitor and evaluate the performance of these H&S policies and make amendments where necessary.The management must develop and implement H&S policies consciously and effectively. Management should also monitor and evaluate the performance of these H&S policies and make amendments where necessary.

It is the responsibility of management to educate employees about H&S dangers and to pay attention out for conditions that are hazardous to employees' health in order to eliminate or lessen them. Employees must be informed on what constitutes safe working conditions and procedures, and management must ensure that they obey the rules and regulations.

2.9.6 Weak legal structures

According to Idubor and Osiamoje (2013), Nigeria's legal structure is weak when it comes to interpreting and applying the governing laws. There is no uniformity in the interpretation of regulations in the Nigerian construction industry, where different regulations are in use, and Idoro (2008) believes that application of the regulations is left to personal discretion. In terms of consequences for non-compliance with OHS regulations, Windapo and Jegede (2013) discovered that there are no significant penalties for noncompliance with OHS regulations that determine compliance with safety practises.

Furthermore, Okojie (2010) claimed that the OHS laws' insignificant penalties do not guarantee compliance in any way. Suggesting that penalties should be used as an indirect tool for enforcing OHS regulations, in order to serve as deterrence to violators. At the moment, the penalties imposed are so minor that they do not deter offenders even when they are enforced. This suggests that the penalties stipulated by the Nigerian Factories Act may render the laws ineffective and make a mockery of the legal system, obstructing enforcement of construction safety.

2.9.7 Beliefs

Accidents were destined and inevitable in construction, according to Kalejaiye (2013), but this was no longer acceptable after the enactment of workplace health and safety rules in England in 1833. Furthermore, Idubor and Osiamoje (2013) use religious beliefs to evaluate OHS compliance; they argue that some employers use fetish rites to prevent accidents rather than adopting proper safety procedures during the construction process.According to Idubor and Osiamoje (2013), some people believe that accidents are acts of God, meaning that they happen because God allows them to. Contractors may do little or nothing to prevent these tragedies as a result of the preceding reasoning; they may not take safety requirements seriously.These findings imply that religious or superstitious ideas often filter into work environments, resulting in a lack of adherence to OHS at work standards in Nigeria's and Africa's construction industry

2.9.8 Lack of awareness and improper medium for information dissemination

The argument that lack of knowledge and understanding of OHS regulations determine the level of compliance within construction regulations is made by Windapo and Jegede (2013) in that there is lack of awareness in most developing countries such as Nigeria for (OHS) regulations and practice, this was also echoed by Idubor and Oisamoje (2013). Therefore, Diugwu *et al.*(2012) contend that lack of knowledge hinders OHS practice, and that lack of adequate Information and statistics also hinder the compliance to safety and health in Nigerian construction industry.

2.9.9 Lack of funding and financial support

According to Nzuve and Lawrence (2012); Idubor and Oisamoje (2013); and Umeokafor *et al.* (2014), capital is required to offer suitable facilities in order to avoid taking corners. Due to a lack of facilities such as clamps and safety belts, a desperate worker may end up risking their lives. This explains why Diugwu *et al.* (2012) claimed that lack of resources can hinder OHS efforts. Consequently, enforcing H&S regulations necessitates the allocation of funds for the effective provision of suitable facilities and the appointment of training officers. Kawuwa *et al.*, (2018), on the other hand, argues that the number of technical and transportation equipment is insufficient, which obstructs the application of H&S regulations in Nigeria.

Many entrepreneurs in Sub-Saharan Africa face the most difficult challenge raising start-up capital for their businesses. Even after getting started, acquiring enough money to keep it thriving is a challenge. The findings of Nzuve and Lawrence (2012) indicate how funding restricts construction SMEs from growing. Nzuve and Lawrence

(2012)confirmed that funding is a major restriction in the SMEs. In a study for Uganda Rural Enterprise Programme (K-Rep). Acharya and Shrestha (2021) found that financing was rated as one of the most critical challenges in research conducted in Nairobi among small construction firms. Adaramola (2012) found finance to be one of the most major constraints for SMEs in Nigeria.

Lack of knowledge about where to source for funding, restrictive lending offered by commercial banks, lack of access to finance, insufficient financing, limited access to collateral, and the fact that financial institutions lack appropriate structure for dealing with SMEs are all examples of finance-related issues, and smaller firms are unable to expand, modernise, or meet urgent consumer demands as a result of a lack of funds.Other challenges to implementing H&S measures for construction SMEs include the following: Inadequate training and retraining; Low capitalization; Ineffective policy implementation; Poor budgetary provision and implementation; Absence of enabling environment (Social, Political, Legislative, macroeconomic and bureaucratic obstacles); and Poor Supervision and Monitoring.

2.10 Strategies for improving level of implementing safety measures

In the Nigerian construction industry, poor safety practices thrive, such as the failure to provide or use personal protective equipment (PPE), the use of substandard tools, and the inability to secure and warn against inherent risks (Agwu and Olede, 2014). As a result, past studies have highlighted the senior and middle management commitment to safety in the Nigerian construction industry (Olutuase, 2014; Dodo, 2014). Accidents and other risks persist as authorities are less willing to take action to address faulty practices.

Qi *et al.* (2022) opined that H&S should be implemented proactively throughout the life cycle of a project, according to with the participation of various stakeholders. Contractors and their employees can be more conscientious about following H&S procedures. Contractors can use comprehensive induction events and regular refresher trainings to keep their personnel up to date on H&S issues. Professional bodies can proactively promote the implementation of higher H&S standards, sanction members who fail to implement H&S standards, update H&S standards in Nigeria to align with others, such as the CDM regulations in the United Kingdom, and put pressure on government (bodies) to enforce full H&S implementation in Nigerian construction industry.Government agencies can impose stricter regulations and enforcement of H&S measures. Academics should also continue to teach H&S concerns in depth and offer new strategies to achieve greater standards.

2.10.1 Communication of health and safety policy and legislation

H&S policy is a written document which recognizes that health and safety is an integral part of the building and construction industry performance (Okoye and Okolie, 2014). It is a statement by the industry of its intentions and approach in relation to its overall H&S performance and provides a framework for action, and for the setting of its H&S objectives and targets. The H&S policy must:

i. Be appropriate to the hazards and risks of the industry’s work activities and include a commitment to protect, as far as is reasonably practicable, its workers and others, such as contractors and members of the public, from health and safety risks associated with its activities.

ii. Include a commitment to comply with relevant H&S legislation, Codes of Practice and guidelines, as a minimum.

iii. Provide a framework for measuring performance and ensuring continuous improvement by setting, auditing and reviewing H&S objectives and targets.
iv. Be documented, understood, implemented and maintained at all levels of the organisation.
v. Clearly place the management of H&S as a prime responsibility of line management from the most senior executive level to first-line supervisory level.
vi. Cover employee H&S consultation, safety committee meetings where they exist, worker participation and safety representation and includes a commitment to provide appropriate resources to implement the policy.
vii. Provide for employee co-operation and compliance with safety rules and procedures.

In every construction site or organization, Site managers should have a written safety policy for their organisation setting out the safety and health standards which it is their objective to achieve. The policy should appoint a senior executive who is responsible for seeing that the standards are achieved, and who has authority to allocate responsibilities to management and supervisors at all levels and to see that they are carried out.Construction safety policy must therefore be developed by each site manager and operating company prior to starting any construction job. Once developed the development safety plan should be placed into a training program that's needed to be participated in by every site worker previous to partaking in any job found on the positioning irrespective of the role’s simplicity. The absence of site meetings as established in this survey implies that workers are not given a forum learn about various risks on the sites and Supervisors equally do not have opportunities to communicate important health and safety matters to the workers. Site meetings are one of the ways of sensitizing workers on their health and safety in the site and should therefore be held frequently.

Adeogun and Okafor (2013) further stated that it is of utmost importance that organizations should develop a formal occupational health and safety policy which states the purpose behind it and requires the active participation of all those involved in the program's operation. Also, the law requires that the policy should be signed by the Chief Executive Officer of the organisation and displayed at a place where the employers normally report for work. Effective occupational health and safety policies set a clear direction for the organization to follow in terms of OHS. The policy should be appropriate to the nature and scale of the organisations' occupational health and safety risks.The policy should outline the industry's intentions and goals for operating a drug-free workplace, clarify the types of substances to be prohibited, such as alcohol, explain the testing procedures used, and state any welfare programs and penalties.

Mandatory testing before hiring, testing for cause and continuous random testing should be addressed by the drug-testing program. Drug tests should be administered as a requirement for employment. In case the results of the test have yet to come out and there is a need of employees then they may be hired on probationary contract. Random drug testing makes it sure that during the project employees do not begin using drugs. Random testing may only cycle through the job every six to eight months because some projects employ a large number of workers minimizing this type of testing to an impediment. Therefore, a more active testing technique is required to determine whether an employee has already used drugs at the beginning of the work.

A testing policy should permit for instant drug testing to meet this requirement following any accidents with just cause and mandatory testing. It will be helpful to check potential users from applying for work and sustain a safe and drug-free workplace by planning and publishing the drug-testing policy in advance (Theophilus and Olumide, 2020).According to section 2 of HSW Act 1974, if the organisation employs more than five people, it must have a written H&S policy. According to Hughes and Ferrett (2016): The key elements of a clearly defined H&S policy and organisation should include:

a. Copy of written H&S policy statement (specifying H&S aims and objectives) dated and signed by the most senior person in the organization, and
b. H&S responsibilities for employees at all levels.

In order to carry out an effective qualitative assessment, the rating indicator concentrates on the clarity, comprehensibility and adaptability of the policy context. The rating indicator for organisations more than five persons is designated as:

i. Acceptable: The health and safety policy contains statements of the organizations Commitment to H&S and is reviewed regularly.
ii. Good: The health and safety policy contains the organization's statement to H&S, specifies the H&S principles in which the organization believes and identifies the general responsibilities of employees.
iii. Excellent: The health and safety policy contains the organization's statement and principles to H&S, and clearly sets out the responsibilities for health and safety management at all levels within the organization in relation to the nature and scale of the work.

It is not necessary if the organisation employs less than five people to display written copy of H&S policy and organisation. However, it should demonstrate the appropriate policy and organisations for H&S. The demonstration could be carried out through interview or other communication forms. The rating indicator is slightly changed to adapt to the means of the demonstration. The following is the rating indicator for organisations less than five people:

i. Acceptable: The demonstration of health and safety policy can explain the organization's commitment to H&S.

ii. Good: The demonstration of H&S policy can explain the organization's commitment to H&S principles in which the organization believes and general H&S responsibilities of employees.

iii. Excellent: The demonstration of health and safety policy can explain the organisation's commitment to H&S and clearly identifies the H&S responsibilities of all employees in relation to the nature and scale of the project.

Legislations such as the OHS Act (85 of 1993) and Construction Regulations of 2014 set out critical standards to which the performance of companies towards production is expected to comply with and be monitored against (Othman *et al.*, 2008). The Act further provides that construction organisations achieve the fundamental principles. It firmly specifies that an H&S plan must be prepared and executed for the protection of all participants against hazards and risks of injuries at and around the working environment. Azimah *et al.* (2009) stated that for H&S performance to be enhanced, the H&S policy and programs to staff must be communicated on a regular basis.

2.10.2 Health and safety plan

The H&S plan is vital in construction organisations as it forms the basis of the H&S management structure. Durdyev *et al.* (2017) stressed that health and safety planbeing part of the tender documents should: indicate (in general terms) the approach to H&S to be adopted by everyone; identify the major H&S risks that affect workers and the general public; outline precautionary measures to be taken; and demand that work be done in compliance with published guidelines and technical standards. Adoption of the project H&S plan as part of the construction production documentation was recommended by Bamisile (2004).

Safety planning involves what particular actions should be taken in case any accident occurs. Staff should be identified with first aid certification. Moreover, safety planning includes making emergency calls, contacting medical staff employed for emergency situation. In the event of a serious accident, this occurs. Electric cranes and lifts is required in emergency evacuation from construction project or from high-rise building. Planning for safety should take into account both fireand evacuation place.

Safety plans should be made earlier and identification in advance is required particularly for the work taking place at heights and processes, which involves heavy lifts. Advance planning is also required in attaching lifelines and barricades, and covering openings. In order to reduce the involvement of many people, lifting heavy loads and movement of large equipment should be planned for after hours.

As construction activities involve a number of risks. A comprehensive safety plan should include measures to ensure that workers are drug-free and alert. Well-planned drug-testing and program can play a key role in achieving this. Drug-testing programs should be planned in a well manner as well as in advance of construction and included into employment policy and project or company hiring. This makes sure that all workers who are associated with and working on project are very much aware of testing methods, drug policy, and actionable penalties of the company.

2.10.3 Health and safety file

The H&S file contains information on the project's health and safety issues for clients, designers, coordinators, contractors, and others involved in construction activities (Andrew, 2021). The information includes essential details regarding the project, structure, or materials that may have an impact on the health and safety of anyone working on the construction site. The CDM coordinator makes the health and safety file accessible to the client at the end of the construction phase work for future consultation on H&S issues.

2.11 Safety programme

A safety programme, according to Ghousi *et al*. (2018), is a vital and necessary basic programme for building construction projects. Personal Protective Equipment (PPE), Safety measures or Collective Protective Measures (CPM), and safety training are all vital components of a successful safety programme, according to Ghousi *et al.* (2018). Investing in safety can help you save money on project-related incidents (Theophilus and Olumide 2020)**.** The type of safety programme chosen by the project authorities has an influence on safety costs. Before looking into the execution of safety measures, a necessary and applicable safety programme should be defined.

2.11.1 Collective protective measures (CPM)

Safety measures are facilities and strategies that are put in place to prevent or limitaccidents during various stages of construction (Okeola, 2009). First aid, protective wears, safety signals, monitoring and enforcement are of significance to OHS. Collective measures should always protect more than one person at any one time and, require no intervention by the user to work effectively.

a. Guardrail Systems

Safety provisions such as guardrails, barriers, or other form of special protection at higher level of operation are provided to protect workers (Misan *et al.*, 2012).

b. Safety Signage

Temporary signage is a tool used in construction to warn the public about the dangers and risks that await them when they enter the construction zone. The design, selection, location and distance, maintenance and inspection are all important factors in influencing the cost of such signage.

c. Scaffolding

Scaffolding is a temporary structure that is used during the construction phase and as a means of transportation to another location (Misan *et al.*, 2012). It can also be utilised as a scaffold field support.

d. Ladder

The use of ladder is required in carrying out works in high places; it facilitates movement from one floor to another floor (Misan *et al.*, 2012). Thus, the ladder must be kept in a good condition in order to avoid something undesirable such as broken or collapsed of ladders.

e. Safety Nets

Safety nets are the nets that are erected around the building throughout the construction phase are known as Mesh nets should be durable and difficult to disintegrate. It must be of a type that meets British Standard 3913 and has been approved by a competent person. There are two types commonly used, which are 100mm and 12-19mm in diameter. The 100mm mesh keeps individuals from falling further to the ground, while the 14-19mm mesh keeps equipment or goods from falling out. Inspection of the nets used should be done once a week to ensure that they are in good shape and that there are no tears or loose net bonding (Misan *et al.*, 2012).

2.11.2 Safety personnel salary

The H&S personnel are important in implementing H&S policy as they monitor safety related matters in the construction industry (Acharya and Shrestha, 2021).The salaries of these personnel officers are also part of costs of accident prevention. Contractors should comply with to prevent accidents on sites. The salary for H&S personnel is the largest investment for contractors possibly due to the requirement under the CDM 1994 Regulations.

2.11.3 Safety monitoring

Managing a project successfully means not just executing it according to specifications within the stipulated time and with budgeted funds but also with optimum safety (Belel and Mahmud, 2012). Theophilus and Olumide(2020) added that it is importantto secure high safety performance in construction. To improve site safety, contractors in construction sites are entreated to create a working policy to enhance safety administration, create an avenue for safety training for its workers, amongst others. They are as well entreated to undertake regular meeting on safety at the project level, ensure adequate measures on safety, making available PPE, put up safety signs and posters, undertake regular safety inspections, and establish a system for acknowledging and awarding safe conduct (El-Mashaleh *et al.*, 2010).

Theophilus andOlumide (2020) also identified that mandatorily enforcing measure like fining, as an effective approach to enhance safety performance on constructionsites. The important attitudes for increasing safety performance and declining risk are to identify root causes of construction hazards and accidents, and manipulating proper precautionary tools and equipment related to the type of construction project and site condition (Theophilus and Olumide, 2020).

2.11.4 Safety analysis

Job Safety Analysis, according to Eggerth *et al.* (2018), is a useful tool for finding, analysing, and limiting risks in industry procedures. To a considerable extent, identifying future safety risks during the design stage can avoid the loss of life and property. For each project alternative, collaboration between the designer and the client is a remedy for reducing the danger of injury. This technique can be used to other project stakeholders such as the general public, users, and the environment. When applied properly, safety risk analysis can help to identify acceptable risks associated with harmful activities.

The severity and probability of the risk are assessed and graded for further analysis. As a result, risk mitigation measures are implemented (Charezehi and Ahankoob, 2012). The Construction Job Safety Analysis (CJSA) method generates a large knowledge-based describing all possible loss-of-control events in construction.The aim of the job safety analysis (JSA) is to identify and evaluate the hazards workers are exposed to when carrying out certain work activities. When carrying out a JSA, the analyse object is the job made up by its sequence of activities. According to Kjellén (2016), jobs that should be subject to JSAs are: Jobs with the potential of severe accidents/hazardous works; Jobs where serious or frequent accidents or near accident has happened; Jobs with a large amount of work hours; and New or changed jobs with uncertain consequences. Executing the JSA consists of five main steps (Kjellén, 2016). These are: Identifying the basic steps of the job; Identifying hazards; analysing the causes; Assessment of risk level; and developing measures to reduce the risk. Kjellén (2016) stresses that the group performing the JSA should include the operators with experience in performing the work.

2.11.5 Safety auditing

In order to establish safety standards on construction sites, it is necessary to monitor, measure, evaluate, and record safety-related issues. The project supervisors are therefore able to plan, organise, and supervise current and upcoming site work in a safe and efficient manner which can be achieved through safety audit. Safety audits are conducted, according to Eggerth *et al*. (2018), to evaluate the H&S policies on construction sites, taking into account regulatory requirements, best practices in the industry, and the contractor's own H&S management systems.

Safety audit, according to Eggerth *et al.* (2018), can demonstrate a proactive approach to safety, help to improve work procedures and ensure that procedures are followed, as well as demonstrate compliance with regulations such as the Construction Design and Management (CDM) Regulations which require reasonable steps are taken to ensure the health and safety arrangements made for managing the project are maintained and reviewed throughout a project. Regular audits can form a crucial part of the project management process and may be undertaken by in-house personnel, or by an independent auditing body. H&S audits on construction sites are key aspect in enforcing H&S measures, however a high percentage indicated that they do not carry out audits. This contravenes the law since the Occupational Health and safety Act in Section 11 requires the occupier of a workplace to cause a thorough safety and health audit of his workplace to be carried out at least once in every period of twelve months by a safety and health advisor.

2.11.6 Safety inspections

According to Ammad *et al.* (2021), Site inspections are usually critical project management activities in the construction industry. The ultimate goal of conducting a site inspection, according to (Ammad *et al.*, 2021), is to analyse the state and conditions of construction components or elements in order to accept, reject, or modify such parts depending on the analysis undertaken. The most reliable method of identifying hazardous elements at the work place is through site inspections, and it typically takes constant monitoring and observation to stay ahead of safety hazards. Safety inspections assist in identifying risks and offer chances to address issues before it results in injuries or accidents (Safety Management Group). Therefore, site inspection is a useful monitoring technique to help ensure safety on construction sites.

2.11.7 Safety records keeping

Typically, safety records serve as evidence for safety claims and indicate to what extent the safety performance on a construction site is acceptable (Eggerth *et al.*, 2018). Safety records must be kept throughout the construction process, Records of construction safety are also required to give information that can be used to locate and address actual safety issues. It is important to identify the safety records for each stage of the construction process and to keep only the necessary safety information (Eggerth *et al*., 2018). It may be necessary to give safety records as a foundation for providing workers with safety assurance in accordance with international as well as national legislation and standards (Eggerth *et al*., 2018). Maintaining effective safety records is essential to ensure effective safety monitoring practice on construction sites.

2.11.8 Toolbox safety talks

Toolbox safety is brief meetings on Safety instructional sessions (Eggerth *et al.*, 2018), usually held on the construction sites. RazaviAlavi and AbouRizk (2021) asserted that toolbox safety talks are usually good construction site practices that offer a way to strengthen safety fundamentals, focus on high-risk cases, and also inform workers of changes to the construction job sites as well as working conditions that may have occurred since their last shift. Site managers need to make sure to immediately go over any accidents or injuries that have occurred and how they might have been averted, according to RazaviAlavi and AbouRizk (2021).

Eggerth *et al*. (2018) presented their research findings on the usefulness of toolbox safety talks to improve worksite safety climate, boost OHS awareness, and increase the impact of training safety. By ensuring that all employees take part in and are interested in the toolbox talk, Sunindijo (2015) helped to increase the effectiveness of the toolbox meeting. Knowing and understanding the topic being conveyed is crucial for effective delivery (Sunindijo, 2015). When properly implemented, the toolbox safety discussions can contribute to an effective safety monitoring system on construction sites.

2.11.9Accidentinvestigation

According to Eggerth *et al.* (2018), accident investigation in the construction industry aids in determining the kinds of accidents that happen and how they happen, this is due to the hazardous nature of construction works. Sunindijo (2015) convincingly protested that accident investigation techniques should be firmly dependent on the theories governing the causation of accident and human error. The relationship between the accident and the preceding human behaviour can therefore be better understood as a result, enabling the identification of the event's primary causes. According to Safety

Management Group, accidents on the building site that resulted in no injuries or property damage should be looked into to assist identify any hazards that need to be fixed. Accident investigations are usually conducted by safety professionals who will visit the scene on site to obtain facts. An efficient accident investigation and report on construction can help to effectively monitor safety.

2.11.10 Use ofbuilding code of practice

The National Building Code (2016) came on board after several debates and agitation by the representative of stakeholders in the built environment and government under the leadership of the Minister of Housing and Urban Development (Eyiah*et al.*, 2019)The code intended to serve as means of enhancing construction project, by disengagement of quacks and the use of 'non-tested' materials in the execution of building production. The objectives of the code are to provide solution to current challenges confronting the Nigerian building industry; this includes: Inadequate town planning in Nigerian cities, occurrence of building collapse and accident-related issues, dearth of construction standards for regulating building designs and production, and the poor maintenance culture in the industry (Subramanian *et al.*,2016).

The code stated in section 7 (49) stated the need to protect the general public and workers anytime a building production process, demolished and maintenance work are to be carried out. The following provisions were made in the code to ensure safety compliance of the operatives involved during production works on site: Section 7 (55) stated the requirement for the use of scaffolds and their components should provide support without failure at least four times the maximum intended loads.

Section 7 (60) stated the requirement for managing health hazards, every construction or maintenance operation which results in the diffusion of noise, dust, stone and other small particles, toxic gases or other harmful substances in quantities hazardous to health shall be safeguarded by means of local ventilation or other protective wears to ensure the safety of the workers and the public as required by this code. Section 13 (12) stated that upon the completion of the building, certificate of fitness to use and habitation shall be issued by the Code Enforcement. This shall made available a certificate of use/habitation within ten (10) days after written application. The certificate shall state compliance with the provisions of this Code and the purpose for which the building or structure will be used in its several parts. All building works shall be executed, installed and completed in a skilful and acceptable manner so as to conform to the provision of the code.

The supervision of the building works shall be the responsibility of a registered architect and engineer in line with their inputs. The management of building production process, including supervision of artisans and tradesmen will be the responsibility of a registered builder. Windapo and Jegede (2013) also noted that contractors (who are SMEs) prioritise savings cost to H&S in the Nigerian construction industry

2.12 Effects of Implementing H&S Measures on Cost of Accidents

Globally, construction workers are twice more likely to be injured as workers and three times as likely to be killed as workers in other occupations (Agwu and Olede, 2014).Cost of an accident at work can be refer to the effects on the costs and the revenue of an organisation that would not have emerged if the accident would not have taken place. Impact on the profitability of an organisation = difference between the profits of the situation with and without accidents at work.

Profit (P) = Revenue (R) – Costs (C)

$\Delta P = \Delta R - \Delta C$

Short-term scenario: increase of the costs

Long-term scenario: decrease of revenue

	ΔR	**ΔC**	**ΔP**
Short term	=	↗	↘
Long term	↘	↗	↘

Source: Hughes and Ferret (2016)

2.12.1 Cost of accidents

According to Hughes and Ferrett (2016), construction accidents have a significant financial impact on families and construction organisations. The cost of a poor H&S record will be reflected on the construction industry’s balance sheet either earlier or later on. According to research by Smallwood *et al*. (2009) in South Africa, 5% of completed project value is responsible for cost of accidents; whereas the implementation of H&S systems is estimated to cost between 0.5% and 3% of the total project value. Therefore, the cost of accidents goes beyond the cost of H&S.According to Hughes and Ferrett (2016), poor H&S management may lead to accidents. However, reduced cost of accidents can be achieved through a positive H&S culture, according to Kamau (2014). Costs of accidents can be classified as direct or indirect costs (see Table2.3).

2.12.2 Direct costs

Direct costs, as defined by Hughes and Ferrett (2016), are costs directly related to an accident that are typically covered by workers' compensation insurance premiums and may include hospitalization, medical costs, liability and property losses, sick leave administration, worker premiums, and temporary disability payments. These expenses are related to injury treatment and any compensation offered to injured workers (Smallwood *et al*., 2009; Hinze, 2006).

2.12.3 Indirect Costs

Hughes and Ferrett (2016) defined indirect costs as those not directly related to the accident but may result from a series of accidents. Hughes and Ferrett (2016) further agreed that these costs are the most evasive cost component associated with construction worker injuries, and the elusiveness of the indirect costs of these injuries lies in the lack of clear definition. Hughes and Ferrett (2016) and Smallwood *et al.* (2009) provides typical indirect costs incurred by construction organisations including reduced productivity of the injured worker(s); reduced productivity of workforce; costs resulting from delays; additional supervision costs; costs of clean-up after the accident; costs resulting from rescheduling of work to ensure timely completion and lost work days among others.

Table 2.3: Direct and Indirect Costs of Accident

Direct Cost	Indirect Cost
Medical expenses	Working day lost
Compensation claims	Cost of hiring temporary labour
Death	Cleaning /waste
Permanent Disability	Sick pay
Pains and Discomfort	Lost time of other employees due to accidents
Litigation cost	
Insurance premium	

Source: Hughes and Ferret (2016); HSE (2006).

There is a significant financial burden on society and individuals as a result of workplace illnesses and injuries. There is an unequal distribution of costs, and some of them are passed on from companies to society and to individuals. To maintain competitiveness in the event of disasters, globalization, and demographic change, all resources and productive capacity that are lost in this manner are, nonetheless, even more crucial to the economy (Subramanian *et al.*, 2016).Many employees in Europe still believe that their employment put their health or safety in danger. Around 28% of European workers claim to have health issues that may have been exacerbated or caused by their present or former jobs (Subramanian *et al.*, 2016).

In the UK, there are many laws that are relevant to accidents and injuries at work. The first concerns reporting and is called the Reporting of Injuries, Diseases and Dangerous Occurrences Regulation (RIDDOR) and was enacted in 2013. In accordance with the regulations, it is the responsibility of employers as well as those in control of the workplace to report any accidents, injuries, or other potentially harmful situations. The Health and Safety Executive in the UK continually monitors on compliance with health and safety laws and regulations. Almost every country in the world's economic growth largely depends on the construction sector. But nonetheless, compared to other economic activities, construction work is regarded to be the riskiest. Construction-related injuries is about 50% more prevalent as compared to all other work (Agwu and Olede, 2014).

Construction workers are especially at risk for muscular-skeletal injuries. Every year, accidents at construction sites cause many workers to suffer injuries or even die. Because of this, identifying the risk at the construction site and taking appropriate steps to reduce it are essential for the construction industry. The risk of work-related injuries can be reduced through regular monitoring and surveillance. Workplace accidents, according to Windapo and Jegede (2013), are unexpected, unplanned events that cause loss of productivity owing to delays in the planned work sequence, injuries, and damage to the equipment and plant that interrupts regular production flow.

Occupational Health and Safety Administration(OHSA) (2005) reports that about 60,000 deaths occur every year around the world due to mishaps at the construction sites, and the rate of fatalities in the sector is much higher as compared to others. A study conducted by Dodo (2014) showed that most of these accidents occur due to lack of commitment to workplace safety. Hitherto, various scholars have examined safety measures in place at the workplace as well as the cost of accidents to the construction employers (Umeokafor *et al*., 2014).

According to Akinwale and Olusanya (2016), the task of carrying construction work during wet season is much difficult as compared conducting work during the dry season as there is increased risk of the worker losing balance on the scaffold and slid off the plank resulting in injury or death. Jebb (2015) reported that a common cause for injuries at the workplace is human error or undesirable actions that compromise workplace safety systems. The undesirable action can be due to lack of awareness about the danger associated with the activity as well as lack of focus or concentration. That's why it is vital that safety training be provided to worker at the construction site about the importance of following safety procedures and rules.

Scaffold accidents are another major reason for injuries and death at the construction site that have been identified by various scholars (OHSA, 2005; HSE, 2006). Frequent building and construction accidents and incidents are axiomatically linked to reduced operational efficiency, increased costs, reduced profitability and shareholders' values

(Hecker and Goldenhar, 2014; Jebb, 2015). See Table 2.4 for the summary of effects on the costs and revenue of an organisation due to accidents at work.

Table 2.4: Overview of the effects on the costs and revenue of an organisation due to accidents at work

Effects of Accidents at Work	Effects on costs	Effects on revenue
Absence of the victim	+	
Interruptions in the production process	+	
Re-organisation of the work	+	
First aid	+	
Accident/case analysis	+	
Administrative follow-up	+	
Recruitment and additional pay for temporary worker	+	
Training of replacement worker	+	
Repair and/or clean-up (accident)	+	
Replacement of damaged equipment/goods (accident)	+	
Fines, increase of insurance premiums	+	
Production losses		-
Loss of orders/clients		-
Company image		-
- Job satisfaction		-

Source: Faith, (2015)

Key

+: Increase of the costs
- : Decrease of revenue

Most construction organisation have a limited idea of costs of accidents at work and work-related ill-health because they simply don't calculate. Limited time and resources, perceived complexity and lack of expertise are the most cited barriers to conducting accidents at work and work-related ill-health cost assessments (Faith, 2015).The importance of implementing safety measures on construction sites and the safety of construction workers cannot be overemphasized because accidents on the job site result in many human tragedies, demotivate workers, disrupt site activities, delay project completion, and have an impact on overall project cost, productivity, and the reputation of the firms involved (Okolie and Okoye, 2012). The costs of construction accidents, according to Kalejaiye (2013), can be enormous and include lost time due to absence from work, medical bills and damages to completed works, idle time of equipment and plant, and a fall in productivity immediately following the accident.

According to Kalejaiye (2013), one of the effects of implementing H&S on the cost of accidents is a slowdown in operations and a loss of productivity. Disruption of current work, replacement training costs, damages to plant and equipment, corrective actions to prevent recurrence of accident, degradation of efficiency expenditure emergency equipment, costs of workman's compensation, medical payments, insurance premium, costs of rescue operations and equipment, loss of function and operations income, payments for settlements of injury or death claims, legal fees for defence against claim.

Accidents generally, affect production and often lead to substantial losses to contractors (HSE, 2006). Different types of costs (both direct and indirect) are associated with accidents occurrence and are further shown in Table 2.4.The impacts of these costs of accidents have implications on contractors. It has also adverse effects on workers such as social cost(e.g. death and permanent disability) that are difficult to quantify in monetary terms and economic cost for instance loss of output, insurance cost) (Mohd and Ahmad,2016).

Kalejaiye (2013) and Mohd and Ahmad (2016) further added that while many organisations may be fully aware of the direct costs of accidents, very little attention is paid to the indirect costs. Many of these costs may be hidden in other costs and thus not fully recognised, example is the production costs and administration costs. Typical indirect costs, many of which can be simply calculated, include the following: treatment costs of the injured employee, such as first aid, transport to hospital, hospital charges, attendance by a local doctor or specialist treatment following the accident; lost time costs, of the injured person, management, first aid staff and others involved;

production costs, example lost production; extra costs for training and supervision and cost of overtime to make up for production losses. A thorough investigation into an accident can also be very time-consuming for management, supervisory personnel.

Other miscellaneous costs include replacement of damaged personal property and incidental costs incurred by witnesses attending court. There is currently no data on average accident costs. First aid treatment for a minor injury accident that took place might just require ten minutes and may be quite inexpensive. On the other hand, if such treatments are frequent, costs can soon mount up. Both direct and indirect costs in accidents involving fatalities and serious injuries can be severe. Consequently, all organizations should conduct accident investigations and costing. Such an operation not only identifies costs and causes, but also clearly highlights loss areas and potential future loss, as well as providing feedback on potential future accident prevention programs.

Employer costs from the accidents included salary costs for replacement staff or overtime payments, production and productivity losses, retraining costs, personal injury claim compensation, repair bills, medical and travel expenses and increased supervision. Consequently, in Nigeria, Part III Sections 7 and 9 of Employee's Compensation Act, (2010) Act No. 13 of LFN, specify the conditions to which an employee is entitled to compensation when injures or suffers occupational diseases in the course of his employment. Part IV Section17 of the same Act specifies the scale of compensation in fatal cases. In the like manner, the stipulations of Part XI of the Insurance Act, 2003 of LFN brings to focus the seriousness of this fact. In Hong Kong, Li and Poon (2013) reveal that there are substantial numbers of court cases with respect to worker's compensation for non-fatal construction accidents. To this effect, the legal and economic implications of health and safety failure on construction site are enormous and any attempt to underrate it will be detrimental to the success of the construction project.

Consequences of accidents in the construction firms bring about costs and in that regard the costs of accidents at work should be considered as the effects on the costs and the revenue of an organisation that would not have emerged if the accident/case of work-related ill-health would not have taken place (EC, 2011). These costs should be avoided because they are by nature non-value-added. They have negative impact on the corporate value creation. The consequences of accidents at work and work-related ill-health increase on the one hand the costs of an organisation and on the other hand diminish the revenue. Often, the effects on the costs of the organisation are immediate while revenues are affected in the long run (as indicated in Table 2.4).Lowered staff morale canbe considered as an effect in the long term. Costs are rising primarily as a result of lost time. This is the amount of time lost as a result of the accident or sickness. It includes time spent on the mediation response to the accident, taking steps for reorganizing the work, and finding substitute, in addition to the victim's absence days, whose lost wages are also partially covered by the insurance system. The cost of an industry is negatively impacted by this unproductive time.

2.13 Safety Performance of Construction SMEs

In general, safety performance is frequently evaluated using unfavourable measures including accident rates, days lost due to accidents, injury rates, and accident costs. By establishing safety objectives and targets, construction firms' management can be assessed for how effective they are at preventing accidents (Kai *et al.,* 2016). Despite the fact that firm size does affect the safety performance of construction contractors, Kai *et al*. (2016) also noted that when a project has a high accident rate, the contractor involved may develop a bad reputation. Therefore, both large and small contractors have a duty to uphold their safety performance in order to keep their reputation in terms of H&S. Abas *et al*.(2020) provided strategies for achieving better construction safety performance and project level, and emphasized that safety performance measurement is most effective when using both 'quantitative and qualitative' safety measurements. Whilst quantitative measures include lost time, severity rates, and Experience Modification Rating (EMR) – a method used to calculate insurance premiums for workers due to accidents; qualitative measures consist of outstanding, average and below average performances, as determined by H&S assessors.

Abas *et al*. (2020) presented numerical profiles of firms and projects with assessing levels of safety performance at the firm and project levels. Based on their findings, they proposed that a number of elements should be taken into consideration to improve safety performance at both levels. Some important project-level factors include increased project manager experience level, more supportive upper management attitude towards safety, reduced project team turnover, increase time devoted to safety for the project coordinator and number of safety inspections. For company level factors, such as upper management support, time devotes to safety issues for the company safety coordinator, number of safety inspections, meetings with the field safety representatives and craft workers (Abosede *et al*., 2019). This is supported byIlori (2017) who proposed the evaluation of safety performance to be evaluated based on the leading indicators and outcome (lagging) indicators.

Leading indicators are seen to be effective when safety performance is considered, and the results will depend on how those indications affect safety performance (Abosede *et* *al.,* 2019). According to Dinesh and Junwu (2020), possible hazards can be identified early on, minimizing unnecessary losses in life and money. This is done by measuring safety performance using leading indicators and evaluating the progress using lagging indicators. Furthermore, to achieve high safety performance, management systems and operational processes can be continuously audited and reviewed to identify current strengths and weaknesses (Dinesh and Junwu, 2020).

Performance measurement is also required if the effect of organisational H&S interventions are to be properly evaluated as it provides important feedback about what work and what does not. Performance measurement provides basis for reviews of H&S practices and organisational processes and can also use for comparative analysis and or benchmarking either between subunits within one organisation or between organisations within the same industry (Dinesh and Junwu, 2020).

H&S performance measurement allows comparison of H&S performance between projects and can also be used by organisations internally to maintain line accountability for H&S and to pinpoint problems areas. H&S performance measurement can be broadly classified in terms of two types of indicators namely lagging indicators also known as downstream indicators or reactive indicators such as the number of accidents and workers compensation statistics and leading indicators also known as upstream indicators.

According to previous research, there are two categories of safety performance indicators: passive indicators and active indicators. Both before-the-accident and after-the-accident indicators are referred to as passive indicators.Before-the-accident indictors include unsafe behaviours and unsafe conditions. After-the-accident indications refer to past variables like the rate of accidents, near-misses, and days lost

(Hsu *et al.,* 2012). When employed in OHS management, passive performance assessments have some drawbacks and restrictions, such as a lack of descriptive information concerning injuries (Abosede *et al.,* 2019). Implementing proactive procedures, such as safety trainings and inspections, as well as efficient safety management and supervision, constitutes active safety performance. Also, a survey of the literature on construction safety performance offers numerous structures that compromise numerous contributing aspects that have an impact on construction safety performance. For instance, previous research on safety climate and its dimensions was one of these (Dinesh and Junwu, 2020).

According to Dinesh and Junwu (2020), practitioners in the construction industry are aware that historic and statistical data such as lagging indicators do not accurately reflect H&S performance. Ilori (2017) reported that when accident and injury rates are deemed acceptable interventions are implemented to change and improve H&S performance.

In addition, Fang and Wu (2013) demonstrated the importance of leading indicators over lagging indicators to monitor the expected H&S performance of construction organisations the advantage is that actions can be taken easily to alter the course of H&S performance if an indicator predict poor performance

2.14 Theoretical Model and Framework

This section discusses the various theories/models that underpin the study's subject matter. The amalgamation of these theories/models gave rise to the conceptual framework of this study in line with the study's objectives.

2.14.1 Theoretical framework for implementation of safety measures on construction SMEs

The theoretical framework offers several benefits to a research work. It gives the researcher room to define the study philosophically, methodologically and analytically (Grant and Osanloo, 2014). Theoretical framework assists researchers in situating and contextualizing formal theories into their studies as a guide (Ravitch and Carl, 2016). The theoretical framework thus aids the researcher in finding an appropriate research approach, analytical tools and procedures for his/her research inquiry. It makes research findings more meaningful and generalizable (Akintoye, 2015). This section undertakes a review of H&S models and theories upon which the study's conceptual framework was developed.

2.14.2 Framework for safety and performance measures

Ahmed and Malik (2013) described construction H&S framework as an outline of interlinked practices, divided into components, which supports a specific approach to a defined objective, and serves as a guide that can be modified as required. Framework for improving construction H&S performance, in the light of this, is a conceptual structure which comprises of interlinked components (input structures) which serves as a guide (process) towards achieving specific objective (output). The output in this case comprises of practices which lead to good H&S performance.

The studies of HSE (2009), Dingatag *et al.* (2006) and Ahmed and Malik (2013) give separate conceptual structure which can interlink to give an implementable framework for improving H&S performance in the construction industry. HSE (2009) developed a good H&S performance measurement model. Dingatag *et al*. (2006) developed a construction competency and H&S framework. Ahmed and Malik (2013), on the other hand, developed a construction site safety implementation framework.

2.14.3 Health and safety implementation models

According to HSE (2009), H&S risks need to be controlled. in order to achieve an outcome of no injuries or work-related ill health and satisfy stakeholders. This is a major step or process to improvement of H&S performance at construction sites. Effective risk control is founded on an effective H&S management system as shown in the model developed by HSE (2009) (as presented in Table 2.5).

Table 2.5: Effective Health and Safety Risk Control

INPUT	PROCESS	OUTPUT	OUTCOME
Uncontrolled → Hazards "The Hazard Burden"	**Health and safety management system Management arrangement (Level 1) Risk Control system (Level 2) Workplace precautions (Level 3) Positive Health and Safety Culture**	**Controlled → Hazards/Risks**	**No injuries No occupational ill health No accidents Stakeholder satisfaction**

Source: HSE (2009)

2.14.3.1 *Westrum's (1993) evolutionary model of safety culture*

Westrum (1993) developed an evolutionary model of safety culture. This model posited that the organisation's safety culture evolves through five main stages; pathological, reactive, calculative, proactive and generative. The pathological stage is when the safety culture is largely underdeveloped. Although in the pathological stage, relevant safety policies, procedures and standards could be in place, the management and the supervisors may still not effectively emphasise the need for safety measures to be integrated in the accomplishment of different project activities (Sellers, 2014; Westrum, 1993).

As the management defy safety mechanisms, miscommunication arises to cause fabricated reports or non-disclosure of all safety problems due to the fear of attracting fines for non-compliance (Sellers, 2014; Westrum, 1993). If the safety issue becomes critical, the executives become only reactionary by responding and addressing only significant areas of failures. In such a stage, the analysis and sensing of the likely safety issues are ignored as part of the proactive approach. Nevertheless, further investments in the reactionary safety management systems causes the executives to develop a calculative safety management system in which only the essential safety management systems are put in place (Sellers, 2014; Westrum, 1993). As the organisation improves its safety management systems and realises the associated business values, the executives become more inquisitive on how to effectively reduce incidents or accidents (Anastacio *et al*., 2010). It is such inquisitiveness that lures the executives to adopt a proactive safety management system by constantly sensing and integrating safety management issues in the process of project conceptualisation and design (Anastacio *et al.*, 2010).

Westrum's (1993) evolutionary model of safety culture stressed that the effective management of such a process is often accompanied by the four steps for a change management process that entail; pre-contemplation (raising awareness about the acuteness of safety issues), contemplation to preparation (outline of the safety plan and integration in safety mechanisms), preparation for action (actual implementation of the safety plan), and maintenance (review and entrenchment of safety culture) (Anastacio *et al*., 2010; Kecklund *et al*., 2016). Although Fleming's (2001) safety culture maturity model was derived from Westrum's (1993) model, Fleming (2001) seems to provide a different perspective on the process for assessing a safety culture maturity.

2.14.3.2 *Fleming's (2001) model on safety culture maturity*

Fleming's (2001) safety culture maturity model posits that an organisation's safety culture maturity is measured by ten elements; management commitment and visibility, communication, productivity versus safety, learning, safety resources, participation, shared perception about safety, trust, industrial relations, job satisfaction, and training. It is also part of Fleming's (2001) assumptions that an organisation only reaches a safety culture maturity if all the technical and system's aspects of safety are functional at their best with the effect that most of accidents and incidents are only linked to behavioural and cultural factors (Kecklund *et al*., 2016). In case the organisation does not meet these criteria, it is critical to redirect most of the critical safety resources towards improving the technical and system's aspects of safety as contrasted to the behavioural and safety features (Fleming, 2001; Foster and Hoult, 2013).

To initiate and improve the organisational safety culture to maturity, it is suggested in Fleming's (2001) model that the executives can use a five levels' managing, relatively low accident rates, cooperating and continuous improvement) analysis framework to gauge the level of the organisation's safety culture maturity. In other words, the interpretation of the total findings in this section would certainly echo the articulation in the theoretical framework. See Figure 2.1 for the Fleming's (2001) model on safety culture maturity.

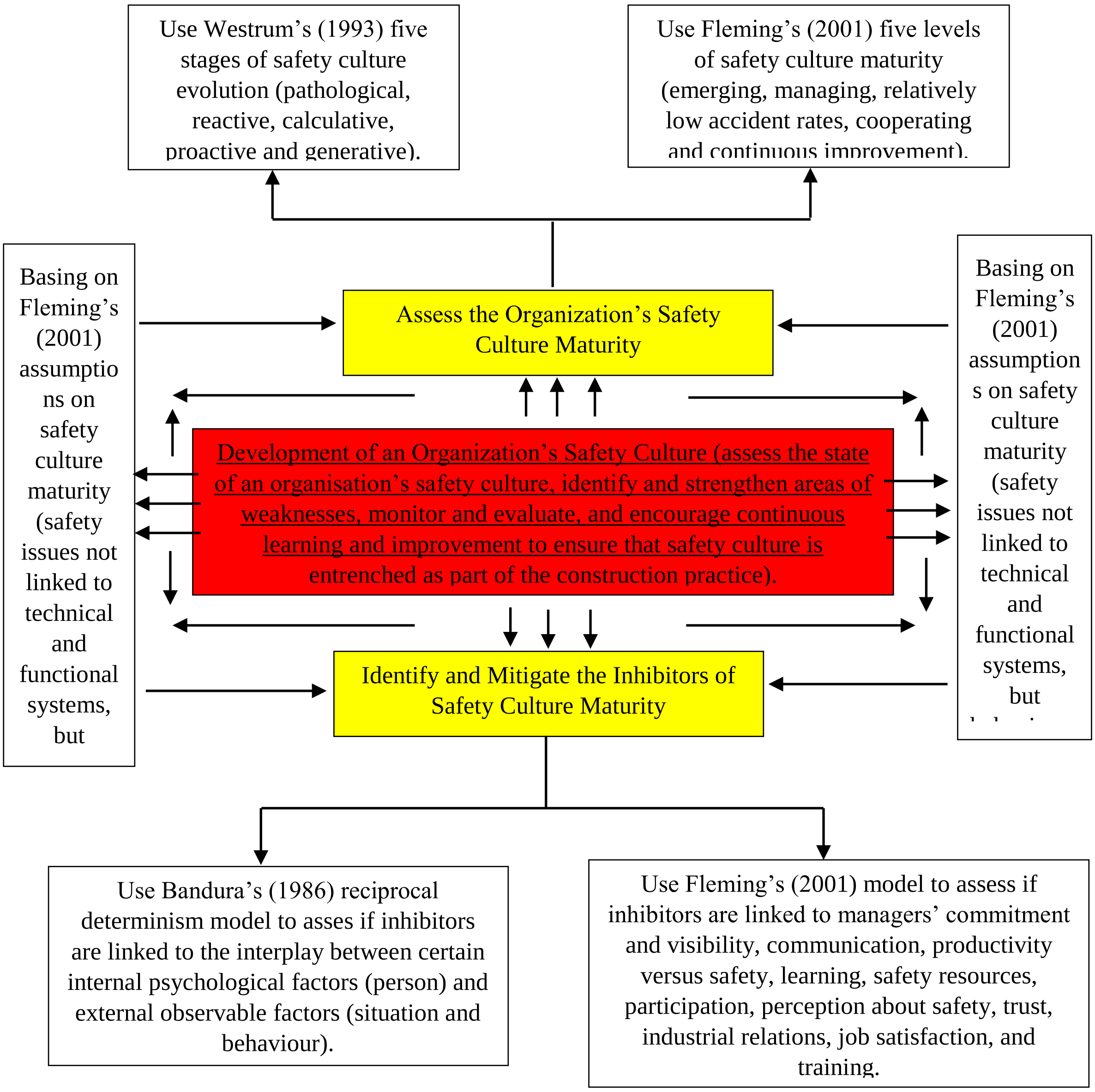

Figure 2.1: Fleming's Model on Safety Culture Maturity
Source: Fleming (2001)

In the context of the theoretical framework in Figure 2.1, the interpretation of theories implies that after the development of an organisational safety culture, Fleming's (2001) assumptions were that lack of a safety culture maturity exists if incidents and accidents are not linked to technical and functional systems, but behavioural and cultural factors provides a basis for diagnosing the state of the organisational safety culture. While basing on Fleming's (2001) assumptions, the theoretical model in Figure 2.1 indicates that a diagnosis may be undertaken to assess the organisation's safety culture maturity so as to identify and mitigate its inhibitors. In such a process, Westrum's (1993) five main stages (pathological, reactive, calculative, proactive and generative), and Fleming's (2001) five levels (emerging, managing, relatively low accident rates, cooperating and continuous improvement) can be used to gauge the level of the organisation's safety culture maturity.

2.14.3.3*Construction competency and safety performance framework*

By creating and sustaining a strong safety culture, a construction safety competency framework can be used to enhance H&S performance(Dingatag *et al.,* 2006). The construction safety competency framework, according to Dingatag *et al.* (2006) presents a clear way forward for the construction industry by promoting a consistent national standard aimed at improving health and safety competency for key safety positions (see Figure 2.2). Dingatag *et al.* (2006) further added that the construction safety competency framework contains five major sections.

i. Developing a positive safety culture

A definition of safety culture and the particular principal contractor/staff actions that lead to a positive safety culture.

ii. Identifying Safety Management Tasks (SMTs) and Safety Critical Positions

A definition of key staff competency requirements, based on identifying the safety management tasks that safety critical positions holders must be able to complete effectively.

iii. Defining Competency Requirements (The Tasks and Positions Competency matrix

The allocation of competency requirements for the identified principal contractor's safety critical positions, that is, "who needs to be able to do what activities".

iv. Integrating the Framework

Guidelines for implementing the competency framework outlined in the document.

v. SMT Competency Specifications and Culture Outcomes to be Achieved

Elements for each of the SMTs identified, including:

a. The process that should be followed when performing the task.

b. The knowledge, skills and behaviours required to complete the task safely and effectively.

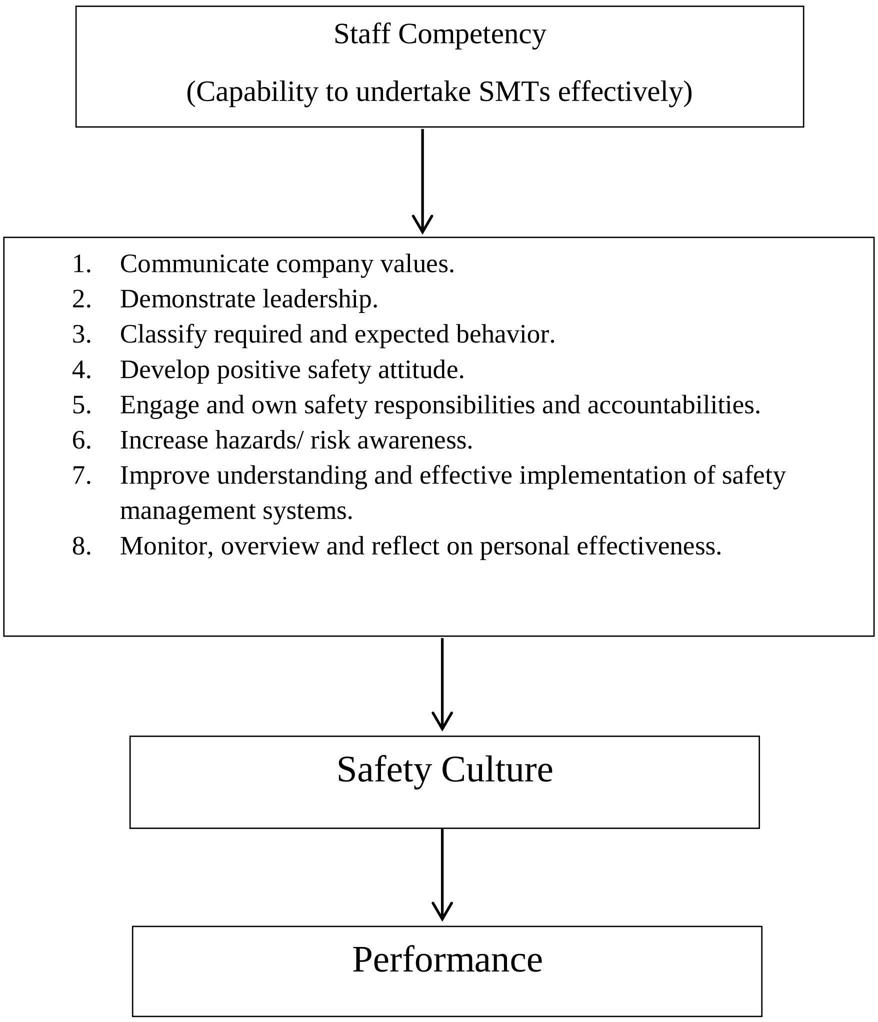

Fig. 2.2: Construction competency and safety performance framework

Source: Dingatag *et al.* (2006)

2.14.3.4 *Framework development for construction safety culture*

This conceptual model is built on theories of safety culture based on relevant previous research literature. This study developed the theory of Zhang*et al*. (2012) which states that the Safety Culture comprises of 4 dimensions, such as: Cultural Behaviour; Culture of Norm and Management; Physical Culture; andCulture of Ideology. The theory is developed with policy and institutional variables as a shaper of Safety Culture in Construction Industry in Indonesia. This is because previous empirical research on the development of the construction work culture does not explain that policy and institutional variables as something that should be integrated as macro implications or impacts that must be improved if they want to develop a safety culture in the Construction Industry. However, various literatures prove that policies and institutions can separately form effective safety culture. While regulation itself is the main variable in establishing an effective and efficient safety institutions (Yoon *et al.,* 2019).

Previous study described that one of the efforts in preventing the level of effective workplace accidents is to improve the policy or regulation of safety management system in the construction industry. Zhang *et al*. (2012) concluded that one of the measures to minimize the risk of accidents is that the government needs to develop, enforce and monitor safety regulations and procedures strictly.

The conceptual model of the study is shown in Figure 2.3. Part of the conceptual model in this study, particularly the linkage between safety culture variables and safety performance is a common model in the study of development of construction safety culture. Therefore, policies and institutions are very important and become the main foundation that is expected to be able to move all the particles that exist within the organization. So the identification of problems that occur is how the Policy and

Institutions can build a culture of safety and improve the maturity level of construction industry so as to improve the performance of Project.

Policies are interconnected with the institutions. In order for the policy to proceed properly, it must be supported by strong institutions. In order for the institution to run and be obeyed by its members, it is necessary to have an intensive structure that contains sanctions and rewards so that the community will obey. Yoon *et al.* (2019) stated that institutions have three components, namely:

1. Formal rules, including constitution, statute, law and all other government regulations. Formal rules form political systems (governance structures, individual rights), economic systems (property rights under conditions of resource scarcity, contracts), and security systems (judiciary and police).
2. Rules of information, encompassing experience, traditional values, religion and all factors that influence the form of individual subjective perception of the world in which they live.
3. Enforcement mechanisms, all such institutions will not be effective if they are not accompanied by enforcement mechanisms.

Improving safety culture and moving towards higher levels of safety culture maturity are considered effective in preventing major accidents (Machfudiyanto, 2017). In previous measurements or research, culture has become an indicator of the level of maturity of OHS management system in Indonesia. The improvement of culture will have a positive impact on the maturity of the H&S management system itself. Figure 3.3 is a conceptual framework for construction safety culture developed by (Machfudiyanto, 2017).

Assaf *et al.* (2001) argued that poor safety performance will increase H&S overhead costs; it will also increases the ultimate uncertainty in the costs of welfare and employee H&S. Ali *et al.* (2018) argued that project performance is hampered by a list of accidents an organisation may have acquired, and this can negatively impact the reputation of the organisation. The results to be achieved in this research is the integration of the process of building a construction safety culture at the macro level mezzo level and micro level so that the safety culture can be moral for every element and behaviour to reduce the level of accidents in Indonesia.

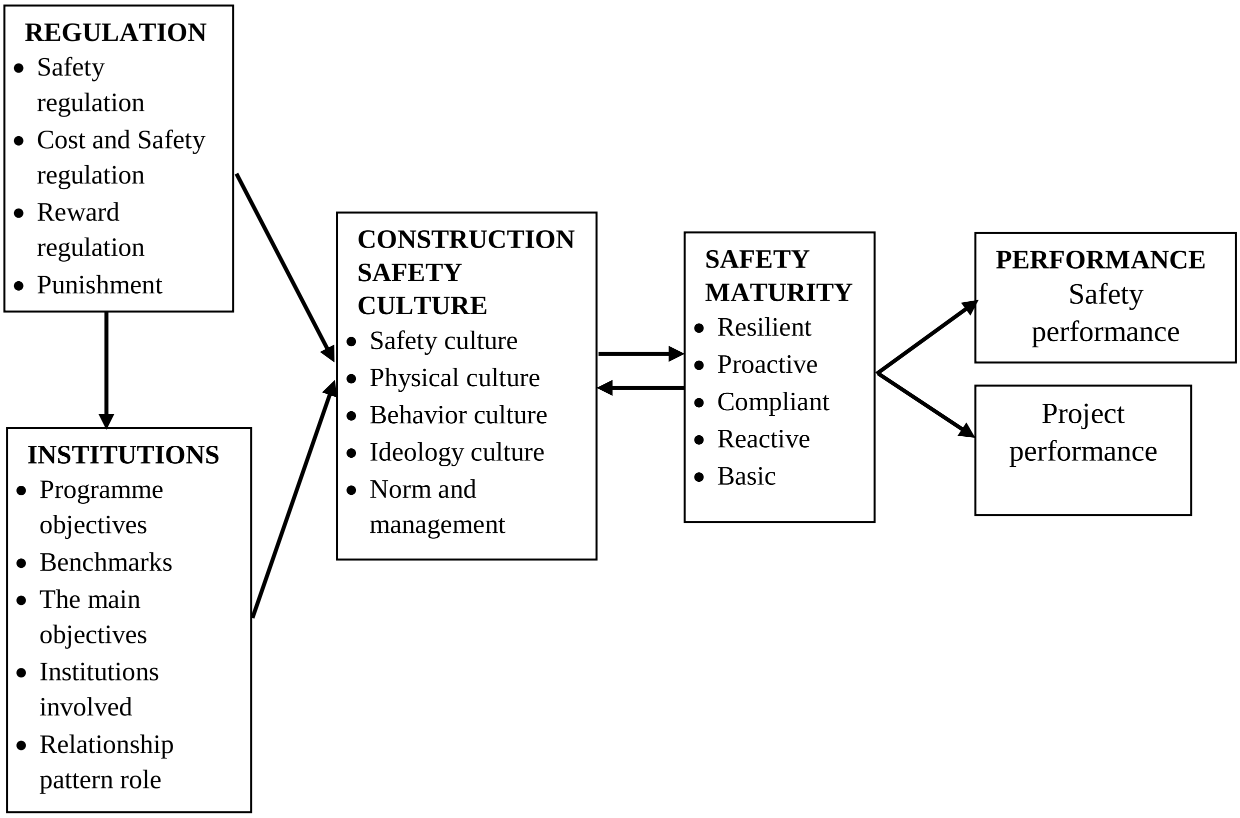

Fig 2.3: Framework Development for Construction Safety Culture
Source: Machfudiyanto *et al*. (2017)

2.14.3.5 *Limitations of the safety models*

Fleming's Model on Safety Culture Maturity was validated using large contractors in Thailand. It might not be possible to test this model or a modified model within SMEs.

This is because SMEs and large organisations are different in terms of their characteristics. Large organisations are more properly resourced and organised than SMEs. Molenaar *et al.* (2009) established that for H&S performance to improve the corporate H&S culture, it should include H&S commitment, H&S incentives, subcontractor involvement, H&S accountability and Disincentives. The combined studies were from America, United Kingdom, Malaysia, Australia, South Africa, Singapore, Thailand and China. It is therefore, evident that there is no consensus on what the critical H&S elements on construction projects are and their impact on SMEs.

From the literature review, it was evident that the safety models developed by researchers previously on accidents in the construction industry and safety implementation were inadequate for decision making on construction SMEs. The tools currently available lack the ability to utilize construction information relating to health and safety, which could enable the identification of benefits to contractors of enhanced H&S performance without identifying the advantages, costs, and expenses of accident prevention, the economic case for accident prevention cannot be considered. Thus, it was reasoned that the application of a safety measures could provide both the insight and understanding of cost and benefits of accident prevention required by duty holders to stimulate a safety implementation.

Testing of drugs and alcohol were excluded as an element of H&S measures to improve H&S performance which was in line with the findings of Kheni *et al*. (2010) that small construction SMEs did not undertake alcohol and drug test despite being established as important in large construction industry. In a separate study by Molenaar *et al*. (2009) it was found that drug and alcohol elements was elective and not compulsory for construction SMEs. The H&S implementation measures to be influenced are: reduction in accidents and injuries, reduction in diseases and illness, reduction in total compensation cost related to accidents and injuries, reduction in damaged property or material, promote H&S awareness and achieve the client's expectations.

The discussions in the previous sections above describe the Health and Safety implementation frameworks propounded by several researchers. There are four models related to safety measures implementation which underpinned this study. The models are H&S Implementation theory (HSE, 2009); Construction safety culture development framework (Machfudiyanto, 2017), Westrum Evolutionary model of safety culture theory and Flemings (2001) model on safety culture maturity.

2.14.4 Safety measures implementation theories

Researchers have studied safety implementation theory as one of the most common frameworks used in the research studies for conceptualizing and understanding issues concerning accident prevention (Decamp and Herskovitz 2015). Interestingly, safety theories have been developed by different researchers. However, most of the theories developed by several researchers revolve around six main categories of safety theory as classified by Osei-Asibey *et al.* (2021), namely the behaviour Theory of Safety; Heinrich's Domino Theory of Safety (HDTS); Energy Release Theory of Safety (ERTS), also known as Dr. William Haddon's Theory; Systems Theory of Safety (STS)/Reason's Swiss Cheese Model; Epidemiological Theory (ET); and Human Factor Theory of Safety (HFTS) which includes Accident/Incident Theory.

Therefore the safety theories considered suitable for underpinning this study are Behaviour Theory of Safety (BTS), comprising the Behaviour-Based Safety Theory and Attitude, Behaviour and Conditions (ABC) Theory of Safety; Heinrich's Domino Theory of Safety (HDTS); Energy Release Theory of Safety (ERTS), also known as Dr.

William Haddon's Theory; Systems Theory of Safety (STS)/Reason's Swiss Cheese Model; Epidemiological Theory (ET); and Human Factor Theory of Safety (HFTS) which includes Accident/Incident Theory.

2.14.4.1 *The behaviour theory of safety*

The theory referred to as Behaviour-Based Safety (BBS) Theory is sometimes known as Attitude, Behaviour and Conditions (ABC) Theory of Safety. Geller (2016) believed in seven basic principles intervention, identification of internal factors, motivation to behave in the desired manner, focus on the positive consequences of appropriate behaviour, the use of planned interventions, information integration, and the scientific approach (Geller, 2016).

The behaviour of employee in workplace safety has been identified as one of the greatest determinants in causes of accident especially as employees interact among a host of varying safety issues (Wijne, 2018). The task can have a negative and positive impact or be connected to the person doing the specified task (Wijne, 2018). According to Geller (2016), managers in improving safety performance among employees, must identify the external factors that influence the understanding and improves the employee's behaviour. The BBS Theory indicates that to prevent accidents on site, there is the need to identify the internal factors of behaviour of stakeholders, especially the construction worker.

Adequate and planned interventions are the tool to reveal a person's potential, and principles guiding motivation to react in the desired manner are to be employed. At the construction site, it is important to support the environmental factors most likely to produce positive outcomes and to eliminate those that would increase the risk of hazards and accidents. Integrating information to increase awareness of these issues among stakeholders is the central principle of this philosophy

The Attitude, Behaviour and Conditions (ABC) Theory of Safety is therefore a framework for understanding and analysing behaviour, and for developing interventions to improve behaviour. Another issue which contributes potentially to employee ill health and must be prevented is negative workplace behaviour such as workplace bullying, which is a work-related psychosocial hazard (Wijne, 2018).

2.14.4.2 *The Heinrich's Domino theory of safety*

One of the simplest models for sequential linear accidents is the Heinrich's Domino Theory. It is built on the series of events that result in an incident. In accordance with the theory, the effect of the event sequence will not result in accident if any of the events that are likely to create an accident are removed (an optical domino cause). The removal is carried out by educating the employees about dangers at work (CSU, 2017). Heinrich (1931) asserted that if even one of the various causes that constitute a "preventable injury" is eliminated when the occurrence of that injury is determined to be the result of the culmination of a series of events, the injury will not occur.

Heinrich's model identified the following five factors: 1. A worker's ancestry and social environment have an impact on their abilities, beliefs, and "traits of character". 2: The employee's negligence or weaknesses that prevent him from providing the job enough attention; 3. A mechanical or physical hazard, such as a worker error, or an unsafe behaviour; 4. The accident; 5. Any injuries or losses as a result of the accident.

According to Heinrich (1931), the responsibility of accident prevention lies, first with the employer. Heinrich (1931) emphasized that an employer-representing manager who is genuinely concerned about safety will make sure that his workers follow instructions.

The manager will always make use of his authority to get cooperation, carry out his plans, and have the dangerous conditions corrected. As a solution for non-compliance, Heinrich advised stringent supervision, remedial training, and discipline. There are nine steps in determining the causes of accidents and dangers and how to take preventative action, according to Heinrich's Domino Theory. These steps are as follows:

i. The person's fault, errors, or carelessness may have been a contributing factor in the accident's background causes
ii. To prevent any harmful acts, the supervisor must strategically inform, instruct, and supervise the worker.
iii. Management's commitment to ensure that there is no setting where hazardous acts might build-up and to ensure that
iv. Policies for the highest standards of productivity and quality are offered to avoid dangerous actions that could result in accidents
v. Corrective actions
vi. Preventative measures must be used
vii. Accident and hazard usually have hidden effects
viii. Indirect cost which eventually lead to
ix. Injury and its associated direct cost

It is believed that any safety programs considering the 10 axioms will influence accident prevention (CSU, 2017). Injuries are caused by preceding factors and by removing the unsafe act or hazardous condition, the effect of the factors may be neutralized, and the accidents/injuries are prevented (CSU, 2017).

2.14.4.3 *Energy release theory of safety*

Dr. William Haddon developed the energy release theory to identify, analyse, and reduce the harm caused by accidents. It is one of the complex linear models. According to Haddon's Theory, accidents are caused by the transmission of energy combined with relevant force that may result in bodily harm and material damage. The theory states that a strategy may disorganize or suppress the series of accident-causing activities. Three strategies have been identified as:

i. Control and prevention of build-up of energy likely to cause injury
ii. Creation of an unconducive environment for the build-up of injurious energy and
iii. Production of measures to serve as counteractive to build-up of injurious energy

Haddon’s theory therefore attempts to deal with prevention of damages caused by accidents, and strategies to disorganize or suppress the chain of accident events likely to cause injury (HSE, 2012).CSU (2017) posited that the basis of the model is that the intensity of the incident energy at the point of contact with the recipient may exceed the recipient’s damage threshold, resulting in an accident.

2.14.4.4 *Systems theory of safety*

Systems Theory is a complex linear model. Over the decades, in scientific description and explanation of natural phenomena, the concept of system has been used. A system is a set of objects and the relationships between the objects and their attributes, Kasianiuk (2020). The environment in a typical system is made up of all objects whose attributes vary and those objects whose characteristics are changed due to the way the system behaves (Osei-Asibey *et al*., 2021).

In the view of Decamp and Herskovitz (2015), much attention has been given to human errors and environmental deficiencies by most of the theories of safety. Yet, the systems theory places a different emphasis on how people and their environments interact. Instead of considering persons to be prone to error, and environment to be full of hazards, a system theory focuses on the harmony between man, machine, and the environment, (Asanka and Ranasinghe, 2015). In normal circumstances, accidents happen very infrequently. The likelihood of an accident occurring increases when the relationship between people, machines, and the environment is interrupted or when one or more of the three components, or the interaction between the three, is altered. Systemic accident models have identified system failures as a major source of accidents rather than just human error (Wijne, 2018).

The next layer could be the wearing of personal protective equipment (PPE) by employee to complete the task. The problem will still get through the initial line of defense and through the first hole if the PPE policy is ignored or i the improper PPE is specified. Yet again, if there is a policy and an employee violates it or wears defective PPE as specified in the policy, the problem will undoubtedly move on. These circumstances will allow an accident to occur, assuming there are no extra defensive measures in place. However, if subsequent layers are offered but have little loopholes, the problems can still get through them and render the layers irrelevant. When appropriate safety training and better understanding and awareness of hazardous accident-prone environments have been created, the accidents may be averted (Wijne, 2018).

2.14.4.5 *Epidemiological theory of safety*

One of the complex linear models is the epidemiological theory of safety (ETS). Epidemiological accident models have their roots in the investigation of disease epidemics and the quest for the causes of their spread. Mensah *et al.*(2020)recognized that injuries, like disease, are equally susceptible to this approach meaning that our understanding of accidents would benefit by recognizing that accidents are caused by a mixture of at least three forces: those of the host, agent, and environment. Man, who has a primary interest, is referred to as the host in the accident's cause. Every tool the host or man uses to alter the environment could be the agent. This could be a different person, piece of equipment, device, or any substance or chemical the host uses. When the environment is equipped with mechanisms that can monitor and control any changes against the interaction of the host and agent, the work system is resistant to accidents. Thus, the gaps in the work system need to be identified and filled with the required resources. This will make the workplace safer from risks and accidents (Eyiah *et al.,* 2019).

2.14.4.6 *Human factor safety theory (Ferrell's human factor model)*

According to the WHO (2009), human factors refer to environmental, organizational and job factors, and human and individual characteristics which influence behaviour at work in a way which can affect health and safety. These factors include several specific elements such as, 1) Tasks, workload, and work patterns; 2) Working environment and workplace design; 3) Workplace culture and communication; 4) Leadership and resources; 5) Policies, programs, and procedures; 6) Worker competency and skill; and 7) Employee attitude, personality, and risk tolerance, Health and Safety Professionals Alliance (HaSPA). The element of human focuses on multiple causes and specific about the causes is distinguished from Heinrich who considers accidents with single chain reaction (Asanka and Ranasinghe, 2015). Ferrell views accidents as the consequence of a single human error yet again. Accidents are caused by bad behaviour, overload, and incompatibility Cleveland State University (CSU, 2017); Decamp and Herskovitz, 2015).

Each of these is a broad category that includes a variety of other, more particular causes. The idea of improper behaviour is likely the most basic because it just comprises two simple sources of accidents (CSU, 2017). First, it's possible that the individual who caused the accident just didn't know any better, and second, it's also possible that they were aware that their actions might cause an accident but intentionally chose to take that risk. According to Decamp and Herskovitz (2015), the incompatibility cause is slightly more complex than improper activities It involves both a person's bad attitude to a situation and subtle environmental elements like an improperly sized workstation.

The overload cause, which is the most complex of Ferrell's causes, can further be broken down into three sub-categories as the emotional state of the individual, capacity and situational factors (CSU, 2017). Conditions connected to being unmotivated and agitated are included in the people's emotional state. The concept "capacity" refers to a person's genetics, in addition to their physical, intellectual, and educational backgrounds. In addition to exposure to drugs and pollutants, the situational elements also include stressors and pressures from one's job that have an effect on one's capacity. The difficulty and danger of the work, as well as the environment's effects such as noise and distractions, all contribute to stress and pressure. The human error may result from the three causes of accident overload, incompatibility, and improper activities (Geller, 2016).

Ferrell's Human Factor Theory Heinrich (1931) is extensively developed upon in Petersen's Accident/Incident Theory to incorporate new components to protect health and safety at work, such as Ergonomic traps, which are workstations, tools, or expectations that are not compatible (management failure); Decision to err which results from unconscious or conscious desire to err (personal failure); and Systems failure or management failure such as policy and training (Heinrich, 1931). Heinrich (1931) further added that the principles of maintaining a safe workplace begin at the top. It is the responsibility of the executive leadership team to create a zero-tolerance culture that is embraced at all levels of the organization. The mandate to work safely should therefore not be compromised. These six theories were selected due to their relevance to the implementation of safety measures at construction sites.

2.14.5 Limitations of Safety Measures Theories

This sub-section shows safety measures implementation theories, their limitations and strengths of the researched theories, from which the theoretical framework for this study was underpinned and the conceptual framework developed. Furthermore, these theories constructs are very significant and plays a significant role to understand the improvement of the implementation of safety measures on construction SMEs. TheBehaviour Theory of Safety (BTS) points to the fact that the behaviour and attitude of workers and other stakeholders are the greatest determinants in workplace safety (Wijne, 2018). The BTS underpins the improvement areas which are lack of H&S training among stakeholders, and bad attitude and behaviour towards work. When the principle of BTS is applied, it will drive the introduction of education and training of the workers and other stakeholders on positive attitude and behaviour, and reduce accidents and hazards, leading to improvement in construction H&S on site. Human error has been identified by most theories and models to be always a possible cause of accidents. Training of employees carefully and continually is therefore an effective strategy to prevent accidents. An effective and better safety training, and improved awareness and knowledge of possible dangers can decrease the chance of an accident occurring (Decamp and Herskovitz, 2015).

The Heinrich's Domino Theory of Safety (HDTS) indicates that the removal of an opticaldomino cause prevents accident (CSU, 2017).Applying the HDTS to underpin the improvement area number 3, that is lack of appropriate skill, will drive the introduction of education and training of the workers and remove any deficiency in a worker likely to cause accident, leading to the expected improvement of construction H&S on site among humans, machines, and environment (Mensah *et al.*, 2020).

The STS underpins the improvement areas; i.e., Bad working conditions and environments, as well as inadequate tools and equipment. By implementing the STS, upper management's commitment to construction H&S will alter, leading to investments in tools and equipment as well as environmental concerns. A safety awareness program, regular meetings, and encouraging safety posters from an awareness program are a few measures to prevent accidents. As a result, the workplace will be safer, and the site's H&S procedures will be improved.

All areas are supported by the Energy Release Theory of Safety (ERTS), which also incorporates tactics that can split or halt the sequence of events that lead to accidents. Improved knowledge of how to reduce damage caused on by accidents will result from educating stakeholders on their individual roles in ensuring Construction H&S on site, improving working conditions, and providing skill training. By reducing accidents and dangers, these techniques can disrupt or suppress the sequence of injuries that cause accidents. Other reasons of accidents, according to Decamp and Herskovitz (2015), include socialization and subculture, which emphasize the value of regular training and safety initiatives. The behaviour of a hazardous employee affects other employees, which increases the likelihood of an accident and makes the problem grow exponentially.

The improvement of work system, i.e., improvement areas are Lack of H&S training among stakeholders, and Bad attitude and behaviour towards work are also underpinned by the epidemiological theory. By applying the theory, gaps in the work process will be identified, and the right steps will be taken to fix them, including providing the necessary resources. This will improve the working conditions on the construction site and allow for the implementation of better construction H&S measures. An essential component of accident causation that demands attention is the physical environment. Decamp and Herskovitz (2015) assert that in addition to the obvious Implications (guard rails, safety signs, hardhats, etc.), it is important to take into account the complex interactions between individuals and their surroundings.

Decamp and Herskovitz (2015) suggested the adoption of the Motivator-Hygiene theory (two-factor theory of motivation) to expose employees to motivators such as positive rewards and hygiene factors including routine good working environment. However, the study did not identify the area of incentive, remuneration, and sanctions as a potential for improvement. WHO (2009) stated that while some workplace factors contribute to satisfaction, others work to avoid dissatisfaction. Offering incentives and awards to workers who prioritize safety is the newest trend. Decamp and Herskovitz (2015) suggested that construction site managers recognize and comprehend the value of maintaining a positive environment. They must pay attention on training and arming themselves to counteract problem employees. They must show keen interest in the safety program errors that cause accidents (CSU, 2017). By applying the Human Factor Theory into practice, stakeholders will develop a sense of mutual respect and a reasonable duty of care toward one another, which will result in clearly defined stakeholder roles and duties and enhanced construction H&S measures for construction SMEs.

2.14.6 Summary of theoretical framework

The discussions in the previous sub-sections described the relevant safety measures implementation theories propounded by several researchers. There are six theories related to safety measures implementation which underpinned this study. The theories areBehaviour Theory of Safety (BTS), comprising the Behaviour-Based Safety Theory and Attitude, Behaviour and Conditions (ABC) Theory of Safety; Heinrich's Domino Theory of Safety (HDTS); Energy Release Theory of Safety (ERTS), also known as Dr. William Haddon's Theory; Systems Theory of Safety (STS)/Reason's Swiss Cheese Model; Epidemiological Theory (ET); and Human Factor Theory of Safety (HFTS) which includes Accident/Incident Theory. Figure 2.4 gives a picture of the theoretical model upon which this study is based.

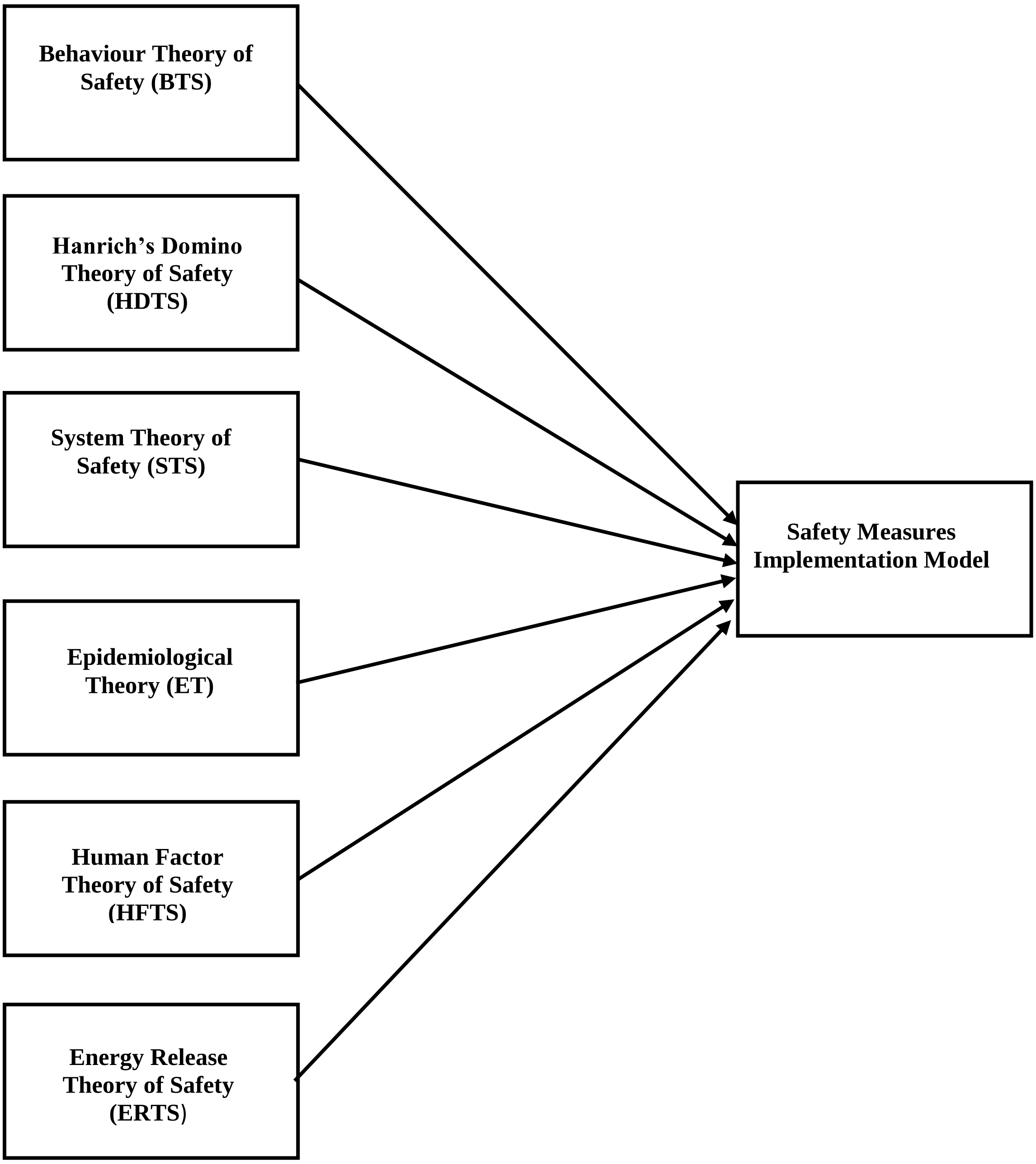

Figure 2.4: Theoretical framework of the study

2.15 Conceptual Framework

A concept is a plan, vision, or a symbolic representation of an abstract idea**.** A conceptual model in research shows the researcher's position on the research problem, which gives direction to the study, and further shows the relationships that exist between different constructs that the study intends to investigateIt could be an existing model that was adopted from a previous research and modified to fit the current investigation. As a result, it is known as an organisation or matrix of thoughts that serve as a focal point for research. So, the conceptual model provides direction and justification for carrying out the subsequent stage (methodology) of this research process (Saidu, 2016).

This section focuses on the development of a model based on the literature review of H&S measures implementation. From the review it was identified that implementation of H&S measures may lead to accident prevention which have economic impact on Construction SMEs contractors, it is necessary to have a conceptual model that brings together these key parameters to be investigated to aid the data collection phase of the study.

It was stated in the literature review that having safety measures in place could provide decision-support tools for H&S management in the construction industry, hence extending efforts to put safety measures in place. The model presented in this part, particularly highlights the possible economic case for accident prevention while establishing the benefits of accident prevention, and supports that argument. It follows logically from this that greater investments in health and safety measures will result in greater accident reduction and performance improvement largely owing to first aid, personal protective equipment, safety training, safety promotion, and safety personnel, which will result in higher accident costs during project delivery.Taking appropriate action or measures to lower the risks of accidents and poor health presents a substantial challenge for SMEs (Kecklund *et al.*, 2016).

The construction site safety implementation model developed in this research would depend on the understanding of good safety measures which can be achieved through management commitment and it is the first safety best practice identified, and one which will be essential to any good safety program. The conceptual model is about the implementation of safety policy, H&S Regulations, safety rules, safety organisation chart, assigning of safety responsibilities to personnel on site, compliance of safety rules with laws, a safe workplace, safety inductions, on-site performance monitoring for subcontractors, and the selection of subcontractors in accordance with safety policies

The model also consists of safety training of workers on site. The training includes induction training of persons at site, providing updated safety information to all the workers on site and to promote safety on construction site by displaying proper sign boards and by introducing different award schemes on site. At this level the H&S critical positions must have been identified in other to build a background to customise the firm's policy.

The next stage is to identify the challenges to effective implementation of H&S measures and its effect on the safety performance. Plans for dealing with problems that can arise on a building site, such as falls, fires, explosions, and releases are known as emergency response procedures. Of hazardous materials including investigation including accident recording and analysis should be an integral part of the safety strategies for enhancing safety performance which should be on continuous basis. H&S measures identified in the literature review are hindered by some challenges that affect the implementation of safety measures in the construction SMEs. These challenges include management commitment, low capitalization, ineffective communication and weak legal structures which in turn causes accident in construction SMEs work high cost effect.

In the conceptual framework, the research suggested that the combination of H&S measures such as H&S communication, H&S Orientation, H&S training & Education, planning, and also the strategies for improving the level of implementation of safety measures by SMEs which include training and enforcement, awareness and advocacy, safety programs including monitoring and inspection are two (2) independent variable that would influence or improve safety performance Finally the conceptual framework believes that the improve safety measures implementation would reduce the cost of accidents by the construction SMEs as indicated in Figure 2.5.

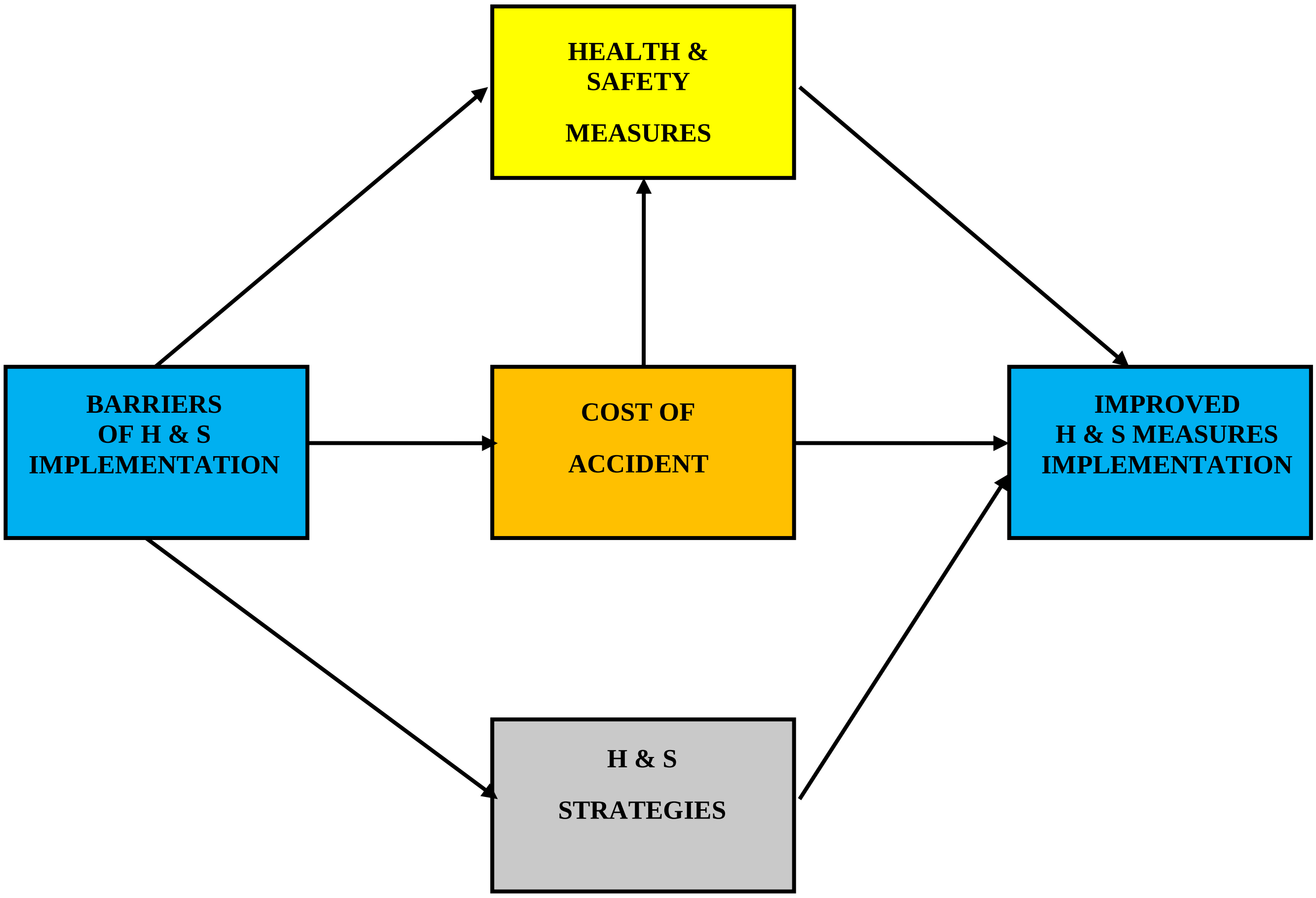

Figure 2.5: Conceptual framework of the study (Researchers Construct (2022)

2.16 Summary of Chapter Two

This chapter has presented the review of literature to capture the major area of the research focussing on the effective H&S Measures required on construction SMEs, challenges affecting the implementing of Safety Measures on Construction SMEs, strategies for improving the level of implementation of safety measures on SMEs as well as the effect of implementation of safety measures on the cost of accidents. This chapter also brings to light literature on the nature of SMEs in Nigeria and how some of their characteristics impact on Health & Safety. As reviewed in this study, various literature suggests a more proactive health and safety legislation in order to achieve effective safety measures implementation by SMEs.

This chapter also discussed the theoretical and conceptual model of the research that is relating to the concept of implementation of safety measures on construction sites by SMEs in Abuja. Nigeria. The theoretical framework dealt with the inter-relationship between the theoretical issues, leading to the achievement of effective safety measures implementation by the SMEs. The conceptual framework highlighted the inter-relationship of the issues leading to the implementation of safety measures by the SMEs, as well as the strategies for the implementation. This construct is in line with the research problem and objectives of the study, as stated in section 1.2 and 1.5 of the study. The next chapter presents the philosophy, the methodology and the techniques of the research.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Research Philosophy

The term "research philosophy" refers to all the epistemological, ontological, and axiological presumptions and initiatives that serve as the direction for a research project (Pathirage *et al.,* 2008).However, researchers philosophically make claims about what knowledge is (ontology), how knowledge is known (epistemology), what values go into knowledge (axiology), how knowledge is written (approach), and the process of studying knowledge (methodology) (Creswell, 2018). What a researcher engages in when carrying out research is termed research philosophy because it encompasses the development and nature of knowledge (Collins, 2010).

Research practices are generally influenced by knowledge bases grounded by philosophical stance on which the researcher has a variety of options to select from the framework and methods employed (Creswell, 2009). This would pave the way for establishing the most appropriate philosophical position for the study. Kagioglou *et al.* (2000) posited that research philosophy is the basis for the development of knowledge.

Philosophy in research is understood under the following basic headings ontology, epistemology, paradigm and axiology.

3.1.1 Research ontology

Ontology is the philosophical study of being. It is an area of philosophy that deals with the nature of being, or what exists. It is concerned with reality and is been presented with questions such as 'what is the meaning of being?' or 'what can be said to exist?' (McQueen and McQueen, 2010). Researchers can base their methodology on two opposing ontological backgrounds, namely the "Parmenidean" and "Heraclitean" ontologies. The Heraclitean ontology emphasises the primacy of a fluxing, changeable and emergent world. The Parmenidean ontology insists upon the permanent and unchangeable nature of reality (Shakantu, 2014). The opposition between the Heraclitean ontology and Parmenidean ontology provides researchers with an in-depth understanding of the contemporary debates in the philosophy of the social sciences and their implications for management research (Shakantu, 2014).

There are basic ontology positions the objectivism (Parmenidean) and constructionism (Heraclitean) (Pete, 2013).In other words, the researcher always presents a specific version of social reality, rather than one that can be regarded as definitive (Pete, 2013). This research is based onParmenidean ontological position because it is based on the social reality concerning implementation of safety measures in construction SMEs.

3.1.2 Research epistemology

Philosophy's area of epistemology is focused on the creation of knowledge, emphasizing how knowledge is acquired and examining the most reliable paths to the truth. (Mishra and Alok, 2017). Ontological assumptions form the foundation of epistemology, which fundamentally governs the interaction between the researcher and reality. It is the branch of philosophy that concerns the origins, nature, methods and limits of human knowledge (Awurigwe, 2015).

The epistemology is discussed under two broad views of objectivism and subjectivism.Objectivism is a position that asserts that social phenomenon and their meanings have an existence that is independent of social actors. It implies that social phenomena and the categories that we use in everyday discourse have an existence that is independent or separate from actors that is, those who are part of the phenomena and those studying the phenomena. This research is based on objectivist epistemology position.

The choice of Objectivistic epistemology in this research is because the problem that is being researched (low implementation of safety measures on Construction SMEs) is an objective problem in need of implementation. The research relies on opinion of the respondents sampled to make a conclusion on the challenges affecting the implementation of safety measures on SMEs.

3.1.3 Research paradigm

A paradigm is a way of examining social phenomena from which understandings of these phenomena can be gained and explanations attempted (Kivunja and Kuyini, 2017).

Research in social science can basically look at three paradigms: pragmatist, interpretivist and positivist (Awurigwe, 2015).

The positivist paradigm includes objectivist and the positivist, the interpretivist paradigm includes subjectivist and interpretivist while the pragmatism research paradigm stands in the middle between the positivist research paradigm and the interpretivist research paradigm. Pragmatism focused on identifying solutions to the issues using theories and frameworks (Awurigwe, 2015). This would relate to a practicality view on how the philosophy contributes to addressing the research objectives and questions.

The adoption of the most appropriate research philosophy depends on the research questions that researchers seek to answer (Morse, 2016).Positivism is an epistemological position that consider the application of the methods of the natural sciences to the study of social reality and beyond. Nonetheless, the phrase goes beyond this idea, despite different authors' definitions of its components.

However, positivism is also taken to entail the following principles: Only phenomena and hence knowledge confirmed by the senses can genuinely be warranted as knowledge, (the principle of phenomenalism); The purpose of theory is to generate hypotheses that can be tested and that will thereby allow explanations of laws to be assessed; Knowledge is arrived at through the gathering of facts that provide the basis for laws; Science must (and presumably can) be conducted in a way that is value free (that is, objective). The research paradigm of this study inclined towards positivism. Facts and data were provided through observations and archival data.

3.1.4 Philosophical stance of this study

The ontological stance of this study was based on Parmenidean assumptions while the epistemological stance of the study is objectivism. The research paradigm inclined towards positivism. An objectivism approach permits the use of quantitative data from external several views chosen to best enable answering of research question from participants in the research (Creswell, 2009; Saunders *et al*., 2009).

The objectives of this study required the use of quantitative data. Effective safety measures required on construction SMEs, Challenges affecting the implementation of safety measures on construction sites by small and medium sized construction firms, effect of implementation of safety measures on the cost of accidents by construction SMEs and strategies for improving the level of implementation of safety measures by construction SMEs was based on quantitative data. The quantitative data also required archival data on improved safety measures variables for construction SMEs.

3.2 Research Reasoning

According to Saunders *et al.* (2012), there are two main categories of research approach. These are induction (inductive approach) and deduction (the deductive approach).

3.2.1Deductive

The deductive reasoning tends to proceed from the general statement to the specific statement, while inductive reasoning tends to go from the specific example to the general statement (Fellows and Liu, 2008). Trochim (2000) noted that the deductive approach involves the processes of identifying theories, generating hypotheses, and making observations to test the hypotheses for confirmation. From the epistemological and ontological perspectives, deductive research represents the positivist and objectivist perspectives to enquiry, symptomatic of a deterministic philosophy (Remenyi *et al.*, 1998).

A prominent feature is that the researcher is supposed to maintain objectivity throughout the investigation so that the research is devoid of bias from personal values. Deduction is widely used in 'natural sciences' and emphasizes the use of 'natural sciences' methods, mainly quantitative methods; whilst induction is most likely to use qualitative methods (Dainty, 2008; Fellows and Liu, 2008).

3.2.2 Inductive

The inductive approach involves the activities of making specific observations, discovering patterns, and generating general conclusions or theories (Fellows and Liu, 2008).In induction, a researcher collects data and develops theory because of data analysis. Research using this approach is likely to be particularly concerned with the context in which such events are taking place .For that, the study of a small sample of subjects is more appropriate than a large number .Researchers with this approach are more likely to work with qualitative data and use a variety of methods to collect the data to establish different views of phenomena. Induction is more related to interpretivism (Saunders *et al.,* 2012).This research made use of deductive approach since the method that is adopted is a quantitative research method in which existing theories were tested, hypotheses deduced and conceptual framework for the study formulated. Quantitative data were collected and relationships were established between the variables in the study, which include to establish relationships between challenges of safety measures implementation and cost of accidents, challenges of safety measures and H&S measures required on construction SMEs, H&S measures and improved safety measures.

3.3 Research Design

A research design is the setting of elements for data collection and analysis with the intention of balancing procedural economy with relevance to the study purpose. In fact, the research design is the conceptual structure within which the research is conducted; it constitutes the blueprint for the collection, measurement and analysis of data (Kothari, 2004). According to Kivunja and Kuyini (2017) the purpose of a research, as well as research questions, is to develop a research design; because they provide important clues about the problem that a researcher is aiming to assess. It also provides a researcher with the strategies for solving an identified research problem (Leedy and Ormrods, 2014).

Accident rate in the Nigeria construction industry is high as a result of lack of public knowledge of the huge potential loss that accident poses, as a result little attention or low priority is given to safety measures implementation, rather employers pay more attention to profitability. Hughes (2008) highlighted the fact that the significance of any research method would be judged in terms of its appropriateness to the nature of the questions being asked; and sensitivity of the methods must, therefore, match the requirements of the research question. Hughes (2008) noted that the theoretical assumptions and underpinnings about a research project, as comprehended by the researcher, provide an important frame that shapes and influences the research design at every point.

For this research, the consideration of the research problem began with an explanation of the background of construction safety, safety measures and implementation of the safety measures in the Nigerian small and medium sized construction firms. Furthermore, a theoretical model of safety measures implementation which allows for the development of a conceptual model that guides the proposed research method, was established. In addition, the designs in research describe the procedures for collecting and analysing the data, in order to answer the research questions posed, which would subsequently provide a way for conducting the research, Dainty (2008) extends the assumption of research design beyond simply identifying techniques that could be used to collect the data; but it also involves the theoretical, methodological, philosophical, and ethical considerations that shape both the design, and aim of the research.

A questionnaire was prepared and an initial pilot survey was then conducted to test the suitability and comprehensibility of the questionnaire, a pilot survey was conducted prior to the major survey. The aim of the pilot study was to test the wording of the questionnaire, identify ambiguous questions, test the intended technique for data collection and measure the effectiveness of the potential response (Creswell, 2018). The survey sample used in the pilot survey was drawn primarily from a database of firms in the corporate Affairs commission Directory and also included participants who had earlier conducted notable research on H&S.

The pilot study was therefore a useful exercise, particularly with regard to gathering information on issues such as questions asked and their relevance to construction health and safety measures implementation for SMEs in Abuja. This helped to sharpen the final version of the questionnaire for the main survey. Following this study, the main questionnaire was modified based on the feedback received; some questions were amended or removed. Altogether and some news ones added depending on which were deemed appropriate and applicable as recommended by the respondents. Themain survey involves the use of questionnaires to collect data from353randomly selected construction SMEs.

3.4 Research Approach

Research approach is a useful strategy that increases the validity in social research (Mohajan, 2017). The methodology adopted for this research was the quantitative method.

3.4.1 Quantitative approach

In quantitative research, measurement must be objective, quantitative and statistically valid. Simply put, it is about numbers, objective hard data. The sample size for a survey is calculated using formulas to determine how large a sample size will be needed from a given population in order to achieve findings with an acceptable degree of accuracy.

This research adopts Quantitative research approach because the data generated from the numeric measurement of the level of implementation of safety measures on construction SMEs and the cost of accidents from the questionnaire are analysed and interpreted by using descriptive and inferential statistics, This provides evidence to support any generalisation about the level of safety measures implementation and safety performance in the Nigerian construction SMEs.

Quantitative research is highly suited to proving cause-and-effect linkages since it produces reliable population-based, generalizable data. It is a philosophical choice whether to use a quantitative or qualitative design. Which approaches to choose will depend on the project's nature, the information needed, the study's environment, and the availability of resources (time, money and human).

For the purpose of this study, a quantitative research approach was adopted because it allows the researcher to collect and collate large amount of quantitative data within strained time. In this approach, questionnaire was used to collect quantitative data to achieve objectives 1 – 2, archival data was used to collect data for objectives 3 and 4 while objective 5 is the development of a model, using quantitative data obtained from objectives 1- 4 which was validated.

3.5 Research Strategy

Creswell (2009) and Saunders *et al*. (2009) classified research strategies into six. These include: survey; case study; grounded theory; ethnography; archival research strategies, sequential mixed method and concurrent mixed method (Creswell, 2009; Saunders *et al*., 2009). In this research two strategies were adopted as explained below:

3.5.1 Survey

The survey method is usually used to address the "who," "what," "where," "how much," and "how many" research questions. It is typically connected with the deductive approach to research (Saunders *et al.,* 2009). After analysing a sample of the population, survey research quantitatively or numerically describes the opinions, trends, or attitudes of a population. A survey technique enables the very efficient collecting of data from a representative sample (Fellows and Liu, 2003).

Data collection in survey strategy can be by questionnaire, structured observation or structured interviews (Saunders *et al*., 2009). A closed ended questionnaire was used for this research. It was used to suggest possible relationships between different variables as well as produce model of these relationships (Saunders *et al*., 2009). The relationship between the use of safety programs and the level of implementation of safety measures was determined.

3.5.2 Archival research

Research questions that are concerned with the past as well as changes over time are addressed using an archival research technique. In order to answer research questions that may be exploratory, descriptive, or explanatory in nature, archival research strategy primarily uses administrative records and documents as sources of data (Saunders *et al.*, 2009). The archival records for this study were collected with the aid of data collection proforma.

3.6 Research Population

The research population is a complete set of elements (persons or objects) that possess some common and distinct characteristic, according to the sampling criteria identified by the researcher (Saidu, 2016).The target population for this study constitutes the number of registered construction firms of small and medium sized medium sized categories (ISO certified) with corporate affairs commission (CAC)and Federation of Construction Industry (FOCI).The respondents include the Owners/managers, professional members and non-professionals, HSE personnel who are staff of the construction firms. A list of 3000 construction SMEs was obtained on 28th of October, 2021from the most recent directory of the Corporate Affairs Commission (CAC) of Nigeria after series of visit.

3.6.1 Sample frame

Babbie (2010) defined sample frame as the list of elements, from which the probability sample is selected. However, a sample frame must be in agreement with the entire population of the study.The sample frame refers to the number of individuals that made up the study population that can be sampled by the researcher. The sample frame for this study is the list of construction SMEs obtained from CAC Headquarters which comprises of professionals randomly selected from the study area.

3.6.2 Sample size

A sample is a segment of a population that has been picked at random for observation and examination. The sample size was calculated using the method demonstrated in equation 3.1 by Glenn (2013) $\boldsymbol{n = \frac{N}{1+N(e)^2}}$------------------------ **3.1**

Where;

n = Sample size,

N = Population size in the sample unit (N=3000)

e = Level of precision which is + 5% (0.05), at 95% confidence level.

Based on equation (4.1) the sample size for this research is (n = 353).

3.6.3 Sampling technique

Sampling is the statistical procedure of choosing a portion (referred to as a "sample") of an interest population in order to make observations and statistical inferences about that population (Bhattacherjee, 2012). Researchers cannot study entire populations because of feasibility and cost constraints, and hence, they must select a representative sample from the population of interest for observation and analysis. It is extremely important to choose a sample that is truly representative of the population so that the inferences derived from the sample can be generalized back to the population of interest (Bhattacherjee, 2012).

According to Blaikie (2010) the two main type of the sampling method, are the probability and the non-probability sampling. Probability samples require that every member of the population has a known and non-zero chance of being included in the sample. The most basic form of probability sampling is simple random sampling, where every member of the population has an equal chance of being included in the sample. (Morgan, 2008; Leedy and Ormrod, 2014: Blaikie, 2010).

The statistical analyses that are possible for quantitative research occur only with probability samples which can justify the demands of knowing the population size, determining the probability of selection for each sample member, and gathering large samples. However, in qualitative research, statistical analyses are not only of little interest; but they are also largely unrealistic; because of the small sample sizes employed in those studies (Morgan, 2008). Morgan (2008) highlighted the two basic advantages of probability samples when considering the quantitative approach:

1. Firstly, they must allow statistical statements about the accuracy of the sample's numerical results.
2. Secondly, they are essential for tests on statistical significance of the sample.

The probability sample includes the following:

a**.** Simple random sampling. According to Morgan (2008); Leedy and Ormrod (2014); and Blaikie (2010), all data source in the population has an equal chance of being included in the sample. The units comprising a population are allotted numbers, and a set of random numbers is generated, and the units having those numbers are included in the sample (Babbie, 2010).

b**.** Systematic sampling: This allows every unit in a list to be selected for inclusion in the sample (Babbie, 2010) it involves selecting individuals or clusters/groups, according to a predetermined order; and the order must originate by chance. The population elements can be put in a list, and be counted (Leedy and Ormrod, 2014).

The simple random sampling technique was used for selecting respondents from the list of registered construction SMEs in Abuja obtained from CAC. It was also used to select respondents from the selected Construction firms that also participated in the pilot survey and whose sites were visited This was used in order to have an unbiased selection and also to give the elements in the population an equal chance of being chosen.

Probability samples require that every member of the population has a known chance of being selected in the sample. The most basic form of probability sampling is simple random sampling, where every member of the population has an equal chance of being included in the sample The small size construction firms were the main focus and project professionals (Project managers, Quantity surveyors, Site engineers, Builders, Architects and Health and safety committee members) make responses on behalf of these firms on the issues relating to health and safety practices in the Nigerian construction SMEs.

3.7 Data Types and Sources

3.7.1 The primary data

The primary data for this study was on the issues relating to safety measures in the Nigerian construction SMEs obtained from a structured questionnaire. A structured questionnaires were designed and self-administered to the project professionals (Project Managers, Quantity Surveyors, Site Engineers, Builders, Architects and H&S committee members) who responded on behalf of the SMEs.

The questionnaire was administered via email, postal administration and face to face administration, and this was to ensure that data from questionnaire instrument was well communicated and obtained for the research. The researcher self-administered the questionnaire face to face by meeting each of the respondents in the selected study area to fill the questionnaire. For some of the respondents that had relocated and not within reach of the study area, emails were sent to them to fill and return back to the researcher.

3.7.2 The secondary data

Secondary data helps in shaping out the structure of the research questionnaire Walker (2010). The secondary data for this study is the archival records kept by the construction firms with the aid of data collection Proforma.

The secondary data for this study were accidents records, safety and implementation data in respect of construction SMEs in Abuja. A data collection format was designed for this purpose, the information contains include the following: project size, project cost, rate of accidents, safety measures and compliance. The selected contractors were asked to complete the format. A data collection instrument was developed by defining and operationalizing the research activities.

3.8 Instrument for Data Collection

A "closed ended" type of questionnaire was used for this study. The Questionnaire were self-administered to the respondents, by the researcher. The questionnaire divided into sections. Section A required information on respondent's background. While the other sections (B – G) were for more specific questions which raises response on the implementation of H&S measures required on construction SMEs, barriers influencing the implementation of safety measures on construction sites by construction SME and the strategies for improving the level of implementation of safety measures by construction SMEs.

The respondents were asked to rank the various sections using a 5-pointlikertscale. The frequency of occurrence included: 1= least effect, 2=Low effect, 3= Moderately low effect, 4= High effect and 5= Very high effect (for likelihood of effect of safety measure on rate of accidents occurrence) and 1= Not implemented, 2= Partially implemented, 3= Fairly implemented, 4= Averagely implemented and 5= Completely implemented. Effective safety measures required on construction SMEs occurrence and a multiple response for the other sections.

3.9 Method of Data Presentation and Analysis

Data presentation were inthe form of tables, figures and charts, this allows the level of compliance and implementation of the various work activities in the construction SMEs to be graphically presented.Data analysis is the systematic organisation of the raw data into a meaningful pattern, which involves inspecting, categorising, transforming, and modelling the data (Babbie, 2010). The method of data analysis employed for this study was descriptive (Mean Item Score) and inferential methods.

3.9.1 Descriptive statistics

3. 9.1.1 *Mean Item Score*

The Mean Item Score (MIS) was used to analyse responses from the questionnaire. This analytical tool was used in order to achieve the second and fourth objective of the study that is to identify and examine the challenges affecting the implementation of safety measures by construction SMEs and; to examine the strategies for improving the level of implementation of safety measures on SMEs.MIS was used to analyse the challenges affecting the implementation of safety measures by construction SMEs, effect of implementation of safety measures on the cost of accident and strategies used for improving the level of implementation of safety measures, so as to ensure homogeneity and validity of the result.

The mathematical formula for MIS is shown in equation 3.1.

$$MIS = \frac{\Sigma W}{N} \text{-------------------------- } (3.2)$$

Where; Σ = Summation,

W = Weight, and

N = Total number respondents

3.9.1.2 *Decision rule*

The decision rule adopted for the MIS are summarized in Table 3.1.

Table 3.1: Decision Rule for Data Analysis

SCALE	*MIS*	**INTERPRETATION** *Level of Implementation*	*Level of effect*	*Level of Severity*	*Level of Effectiveness*
5	4.51 - 5.00	Completely Implemented	Very high effect	Very Severe	Very Effective
4	3.51 - 4.50	Averagely Implemented	High effect	Severe	Effective
3	2.51 - 3.50	Fairly Implemented	Moderately low effect	Fairly Severe	Fairly Effective
2	1.51 - 2.50	Partially Implemented	Low effect	Less Severe	Less Effective
1	1.00 - 1.50	Not Implemented	Least effect	Least Severe	Least Effective

Source: Adapted and Modified from Shittu *et al.,* (2015a)

3.9.2 Inferential statistics

Inferential statistics are mathematical methods that employ probability theory for deducing (inferring) the properties of a population from the analysis of the properties of a data sample drawn from it. It is concern also with the precision and reliability of the inferences it helps to draw (Business Directory, 2019). For the purpose of drawing useful inferences and generalise the results of the sample to the whole population, the inferential tools used were the Factor Analysis, Multiple Regression and Structural Equation Modelling(SEM).

3.9.2.1 *Factor analysis*

Factor analysis can be used to reduce a large number of related variables to a more manageable number, prior to using them in other analyses such as multiple regression or multivariate analysis of variance. It is regarded as a 'data reduction' technique. It takes a large set of variables and looks for a way the data may be 'reduced' or summarised using a smaller set of factors or components. It does this by looking for 'clumps' or groups among the inter-correlations of a set of variables. This is an almost impossible task to do with anything more than a small number of variables. It is widely used by researchers involved in the development and calculation of tests and scales. The scale developer starts with a large number of individual scale items and questions and, by using factor analytic techniques; they can refine and reduce these items to form a smaller number of coherent subscales.

There are two main methods of factor analysis namely, exploratory and confirmatory. Exploratory factor analysis is often used in the early stages of research to gather information and explore the interrelationships among a set of variables. On the other hand confirmatory factor analysis, is a more complex and sophisticated set of techniques used later in the research process to test (confirm) specific hypotheses or theories concerning the structure underlying a set of variables (Pallant,2011).

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were used to measure the strength of each variable during factor extraction and rotation (Fellows and Liu, 2003). In order to determine variables to be retained for further analysis, Hair *et al*. (2010) developed a guideline using sample size and factor loadings; typically, the value of a factor loading ranges between 0 and 1. From the model developed by Hair *et al*. (2010), a factor loading of 0.55 and below is appropriate when the sample size exceed 100, but when sample size is below 100, factor loadings of 0.60 and above will be appropriate for further analysis. This indicates that the bigger the sample size, the lower the factor loading and vice versa. This position is further supported by Field (2013), who claimed that with a sample size of less than 100, a factor loading greater than 0.6 may be considered acceptable. Hence, all variables with factor loadings equal to, or greater than 0.60 were considered adequate for hypothesis testing and model validation in this research. Based on this, the various H&S measures, strategies and challenges of H&S as well as the effect of cost of accidents identified from the literature review were reduced to a manageable number.

3.9.2.2 *Multiple regressions*

Multiple regressions is a technique that can be used to explore the relationship between one continuous dependent variable and a number of independent variables or predictors (usually continuous). Multiple linear regression is based on correlation but allows a more sophisticated exploration of the interrelationship among a set of variables (Pallant, 2011).It is a tool for analysing the predictive forces and the extent of the independent variables' effects on the dependent variable (Kerlinger and Lee, 2000; Pallant, 2011).

This study adopted multiple linear regression analysis to test the hypotheses and appraise the resulting models. In the multiple regression analysis, all independent variables are entered at the same time. Each independent variable is evaluated in terms of its predictive power, over and above that offered by all the other independent variables (Pallant, 2011). This leads a researcher to derive an equation in which each predictor variable has its own coefficient and the dependent (outcome) variable is calculated from a combination of all the variables, multiplied by their respective coefficients, plus a residual term (Field, 2013). These coefficients denote the comparative contribution of the independent variables to the overall model(s) prediction, and simplify the clarification of the effect of the predictive power of the variable (Hair *et al.*, 2010).

The influence of independent variables on dependent variables was measured using R^2 which is the coefficient of determination and it ranges from zero to +1. This was used in objectives 1 – 4 to determine the effects of the itemized constructs on safety measures implementation. The multiple linear regression analysis was chosen for this study because it enables the multiple independent variables to be entered at the simultaneously so that its predictive ability could be checked against dependent variables one at a time since there was no need to control any of the variables.

3.9.2.3 *Partial Least Square- Structural Equation Modelling (PLS-SEM)*

Structural Equation Model (SEM) is a method for estimating, representing and testing a theoretical network of mostly linear relations between observed and construct variables. It is more comprehensive and adjustable than any other path (such as multiple regression, correlation and ANOVA), providing means of governing not only for extraneous variables, but also for measurement errors as well (Hair *et al.*,2017).SEM is said to be a second-generation multivariate data analysis (MDA) incorporating certain aspects of factor analysis and regression analysis in a bid to evaluate the relationship between defined measurement variables and predetermined constructs (Chin, 2010; Hair *et al.*, 2014).Recent use of this method in the development and testing of hypotheses has become common in most social science research (Hair *et al.*, 2017). As stated by Ali *et al.* (2018), in most researches, the key reason for using this method is its ability to test simultaneously series of interrelated dependency relationships that occur in various sets of constructs, calculated by multiple variables and at the same time account for measurement error.

Furthermore, Ali *et al.* (2018) noted that PLS-SEM is the most popular technique in various fields that has gained significant attention. Its use is evident in business marketing (Hair *et al.*, 2012; Henseler *et al.*, 2009), management of organisations (Sosik *et al.*, 2009), international management (Ritchey. 2008), and management of human resources (Ringle *et al.*, 2019). In construction-related studies, PLS-SEM has equally gained significant recognition (Aghimien, 2020).

This research adopted PLS-SEM, specifically Smart PLS Version 3.3.2 and SPSS V 23 to determine the hypothesized relationship between the constructs. According to Wong (2013), besides the benefit of PLS-SEM is it has higher statistical power which is best to use in the exploratory study (Hair *et al*., 2017). Initially, a preliminary analysis was conducted to confirm the fitness of data for PLS-SEM modelling. Secondly, PLS-SEM validity of measurement and structural model along with hypotheses test were carried out. Here, the measurement model fixes the relationship between constructs and attributes while the structural model determines the relationship between constructs and unobserved variables (Ali *et al*., 2018; Wong (2013). SmartPLS (version 3.3.2) (software package) was used to compute and evaluate the PLS structural equation model, based on the quantitative data collected. The path model as presented in Chapter 3, was tested in Chapter 4 where a safety model was developed (Hair *et al*., 2014). Details of how PLS-SEM was computed and generated, are given in Chapter 4. Significant p-values of 0.05 were adopted. Lastly, the evaluation matrix was carried out to identify the real condition of all categories of construction SMEs in terms of safety measures implementation.

3.10 Summary of Analytical Techniques

The identified safety measures required on construction SMEs from literature reviewwere ranked in order of importance with the use of Mean Item Score (MIS).This was executed to achieve the first objective of the study. The challenges of safety measures implementation were examined through the use of site observation and questionnaire and subsequently analysed using Frequency Counts, Percentile and

(MIS). To achieve objective 2 of the study. The effects of safety measures on the cost of accidents in construction projects were determined with the use of MIS. This assist in the achievement of Objective 3. The use of MIS was also employed to examine the strategies for improving the level of implementation of safety measures which was identified from Literature Review and Questionnaire. The fourth objective of the study was achieved through this means. The model for implementing safety measures onSMEswas developed by using graphical representation of the strategies for the implementation of safety measures in SMEs by all stakeholders based on the linkages and interrelationships of the results of Objectives 1 - 4. Table 3.1 gives a breakdown of the procedure for data collection and analysis for the study. This will assist in achieving the fifth objective of the study. The developed model was validated using Structural Equation Modelling (SEM). See Table 3.2 for a summary of the analytical techniques.

Table 3.2: Analytical Techniques of the Research

S/N	Objectives	Type of Data	Source of Data	Method of Data Collection/Instruments	Method of Data Analysis
1	To Identify and examine the effective safety measures required on construction SMEs in Abuja, Nigeria	**Primary Data**: Safety Measures identified from Literature Review and Interview.	**Primary Source**: i. Literature Review ii. Questionnaire	i. Questionnaire	i. Mean Item Score ii. Regression analysis iii.SEM Analysis
2	To examine the challenges of safety measures implementation on construction SMEs in Abuja, Nigeria	**Primary Data**: i. Important Safety Measures identified from Objective 1. ii. Attitude towards adherence to the implementation of safety measures as observed from visits to sites.	**Primary Source**: i. Questionnaire ii. Site Observation	i. Site Observation ii. Questionnaire	I. Frequency Counts/Percentile ii. Mean Item Score iii. SEM Analysis
3	To determine the effects of implementation of safety measures on the cost of accidents in construction SME.	**Primary Data**: Safety Measures identified from Literature Review **Secondary**: i. Recorded Rate of Accidents. ii. Amount of Compensation paid to victims.	**Primary Source**: Safety Measures identified from Questionnaire **Secondary**: i. Recorded Rate of Accidents. Ii. Amount of Compensation paid to victims. (Archival Data)	i. Questionnaireii. Data Collection Proforma	i. Mean item Score ii. Regression Analysis. iii.SEM Analysis
4	To examine the strategies for improving the level of implementation of safety measures on the small and medium size construction firms	**Primary Data**: Effective strategies for improving the level of implementation of safety measures identified from Literature Review.	**Primary Source**: i. Literature Review ii. Questionnaire	i. Questionnaire	i. Mean Item Score ii. Regression Analysis iii.SEM Analyseis
5	To develop a model for implementing safety measures on construction SMEs.	Primary and Secondary Data.	Primary and Secondary Sources.	Results of Analyses of Data Collected from: i. Questionnaire ii. Observation iii. . Data Collection Proforma	Graphical representation of the strategies for the implementation of safety measures in construction projects by all stakeholders based on the linkages and interrelationships of the results of Objectives 1 - 4. ii. SEM Analysis

Source: Researcher's Construct (2021)

3.11 Reliability and Validity Test

Reliability and validity show how much an instrument or device (e.g. a questionnaire) precisely measures what it is required to measure (Bryman and Bell, 2007. Numerous techniques can be utilized to guarantee the validity and reliability of questionnaires example is surveying the inquiries from at least two research specialists to decide if they measure what they should measure (Vogt, 1999; Ruane, 2011). Cranach's Alpha test is used to measure the internal consistency or reliability of a set of items and used when the multiple Likert's scale is adopted in a questionnaire survey. Cronbach's alpha test is the most common measure of internal consistency or reliability of a set of items and used when the multiple Likert's scale is adopted in a questionnaire survey. According to George and Mallery (2003) the following rules of thumb are applicable: "greater than 0.9 – Excellent, greater than 0.8 – Good, greater than 0.7 – Acceptable, greater than 0.6 – Questionable, greater than 0.5 – Poor, and less than 0.5 – Unacceptable".

If the Cronbach's Alpha value is less than 0.7, it is recommended to try to delete one variable at a time from the questionnaire list of survey. By doing this, the consequences or changes on the Cronbach's Alpha could be observed. For instance, if the Cronbach's Alpha value become improving and more than 0.7 after one of the variables had been deleted, then it suggests that the variable should be excluded from the construct. Cronbach's Alpha Test was carried out to ascertain the reliability of the quantitative data collected for the study. Table 3.3 shows the reliability test for the constructs for the study. Cronbach's Alpha Test was carried out to ascertain the reliability of the quantitative data collected for the study. Table 3.3 contains result of the reliability checks for the various sections of the questionnaire.

Table 3.3 Results of Cronbach's Alpha for Reliability Test

S/No.	Variables Tested	Cronbach's Alpha	No. of Items
1	Identify and assess the level of implementation of effective safety measures required on construction SMEs.	0.717	26
2	Identify and examine the challenges of safety measures implementation on construction SMEs.	0.580	23
3	Determine the effects of implementation of safety measures on the cost of accidents in construction SMEs.	0.775	19
4	Examine the strategies for improving the level of implementation of safety measures on the small and medium sized firms	0.863	23
	Average	***0.734***	

Source: Researcher's Field Survey (2021)

According to Mohajan (2017), validity refers to the functionality and accuracy of the reading of the instrument. Avellar *et al.* (2017) asserted that there are many ways which the validity of a measurement can be tested to establish the quality of a research. Validity test applies to all stages of a research project including design, collection of data and analysis. Four main tests of validity exist which includes external validity, internal validity, construct validity and evidence-inference validity (or reliability) (Saunders *et al*., 2009; Creswell and Clark, 2011; Vogt 1999). These tests are discussed below indicating the steps taken in this research to determine them.

External validity: External validity is concerned with the generalisability of the findings of the research and is the main criterion for deciding the quality of the population and samples selected for the study (Saunders *et al*., 2009). In order to achieved external validity in the current research, the survey respondents ensured that construction SMEs formally registered with CAC in Abuja was selected to give the relevant information for the study.

Internal validity: Internal validity is deals with the extent to which the research design and data collected are able to adequately address the research question(s). The test of internal validity is applicable for explanatory and causal studies (Yin, 2003). Internal validity was ensured through the extensive review of relevant theories leading to a carefully drawn research design. In designing the research, an appropriate methodology was adopted which achieved the specified objectives.

Construct validity: Construct validity deals with coding of the data which determines the extent to which the operationalisation of the constructs and concepts in the data collection instruments are appropriate for addressing the research question(s) (Saunders *et al*., 2009). Two steps were taken to ensure construct validity in the current research including pilot study of the questionnaire and validation of the results from the sampled construction SMEs. The pilot study allowed for assessment of the validity of the questions asked, and disclosed any ambiguity in the questions before being administered to more of the respondents in the final questionnaire.

Evidence-inference validity (reliability): Evidence-inference validity borders on the appropriateness of the data analyses techniques used in the research and the extent to which they lead to reliable interpretations of results obtained (Creswell and Clark, 2011). To attain evidence-inference validity also known as reliability in the current research, the data collection analysis techniques were carefully selected. PLS-SEM technique was also used to validate the model for the study.

3.12 Pilot Survey

Pilot survey is the process whereby you try out the research techniques and methods which you have in mind, see how well they work in practice, and, if necessary, modify your plans accordingly (Creswell, 2018). All questionnaires were piloted initially, this have been completed by a small sample of respondents. The pilot survey will test whether the questions are intelligible, easy to answer and unambiguous,throughobtaining feedback from respondents (Fellows and Liu, 2008). The researcher carried out a pilot survey on the questions that has to do with the objectives so as to ascertain reliability of the research. However, the result of the pilot survey was analysed.

The pilot study was conducted by distributing questionnaires to 50 small and medium sized construction firms within the study area. All observations and suggestions from the pilot study were carefully evaluated before construction of the final questionnaire for administration. The pilot study respondents also participated in the main survey. The pilot study was undertaken after ensuring that all the objectives of the research had questions aiming to address them. The data from the pilot survey was analysed using regression analysis to establish the relationship between the variables. The results from the regression statistics showed a predictive value of 0.8%, 4% of the constructs. The values were very low; hence regression had a low predictive ability. Therefore, a higher analytical technique (PLS – SEM) was chosen as it gives a higher predictive power as compared to regression analysis and can also be used to validate the model whereas regression cannot.

3.13 Summary of Chapter Three

The research concepts and methodology that were followed to achieve the objectives of the study, as outlined in this research project were discussed in this chapter. It begins by bringing into focus the philosophical underpinning and assumptions and paradigms of the research and it then proceeds with the explanation of the methodology and methods employed in the study. The next chapter gave a detailed discussion of the presentation and analysis of the data collected from the fieldwork.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Research Data Presentation

In order to achieve the objectives of this research, a survey was conducted which involved the administration of a total of353copies of questionnaire among construction professionals and management staff in small and medium sized construction firms in Abuja. Among the 353 copies of questionnaire administered, 154 which represent 43.62% were not returned while 199 which represent 56.38% were returned and used for analysis. Hence, a greater percentage of the questionnaire was retrieved making the data reliable for analysis. Table 4.1 presents a breakdown of the response rate to the questionnaire distributed.

Table 4.1: Breakdown of Research Data

S/No.	Category of Data Collected	Frequency	Percentage (%)
1.	Not returned	154	43.62
2.	Returned and used for analysis	199	56.38
	Total	***353***	***100***

Source: Researcher's Field Survey (2021)

4.2 Analysis of Respondents' Profile

This section presents the profile of respondents considered for data analysis. The years of experience of the respondents are presented in Tables 4.2 while information on the age of the construction firms is presented in Table 4.3. The general profile of the construction firms, on the other hand, is presented in Figures 4.1 – 4.4.

Table 4. 2: Years of Experience of Respondents

Years of Experience	Frequency	Percentage (%)
1 - 5 Years	43	22.05
6 - 10 Years	79	40.51
11 - 15 Years	42	21.54
16 - 20 Years	30	15.38
Above 20 Years	5	0.52
Total	**199**	**100.00**

Source: Researcher's Field Survey (2021)

Table4.2 reveals the range of years of experience of the respondents. The result shows that most of the respondents (62.56%) have had between 1-10 years' experience while 37.44% of the respondents had between 11-20 years' experience. This implies that the respondents were suitable to provide reasonable and accurate answers to questions in the research questionnaire.

Table 4.3: Age of Firms

Firms' Age	Frequency	Frequency (%)
1 - 5 Years	53	26.63
6 - 10 Years	71	35.68
11 - 15 Years	40	20.10
16 - 20 Years	20	10.05
Above 20 Years	15	7.54
Total	**199**	**100**

Source: Researcher's Field Survey (2021)

Table 4.3 shows that 26.63% of the construction firms have been in existence for 1-5 years; 35.68% have been in existence for 6-10 years; and 20% of the construction firms have been in existence for 11-15 years. It was also revealed that 10.05 % of the construction firms have been in existence for16-20 years and 7.54% of the remaining of the construction firms has above 20 years' experience. This shows that the construction firms that have been in existence from 6 years and above are old enough to have the requisite experience and resources to provide reliable information needed for the research.

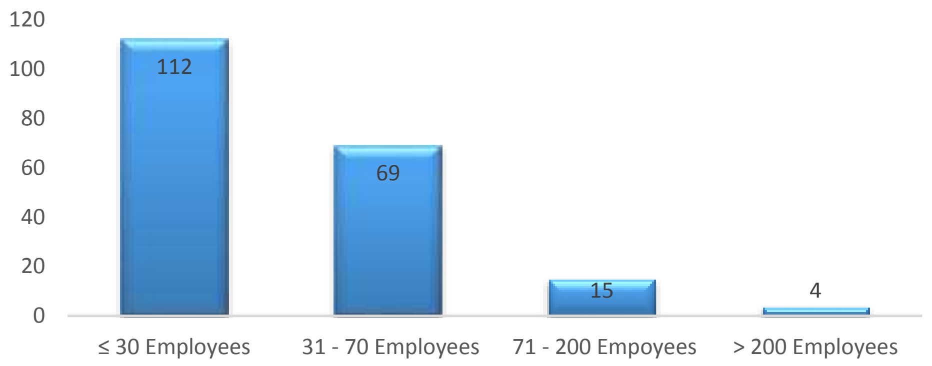

Fig. 4.1: Size Band of Firms from 2015 - 2019

Figure 4.1 revealed that 112 (56 %) of the construction firms have not more than 30 employees while 69 (34.5%) of the construction firms have between 31-70 employees and the remaining 19 (10%) of the construction have employees between 71 -200 and greater than 200 employees. This indicates that the construction firm'sfall between the range of small and medium-sized construction firms and therefore fit for the study.

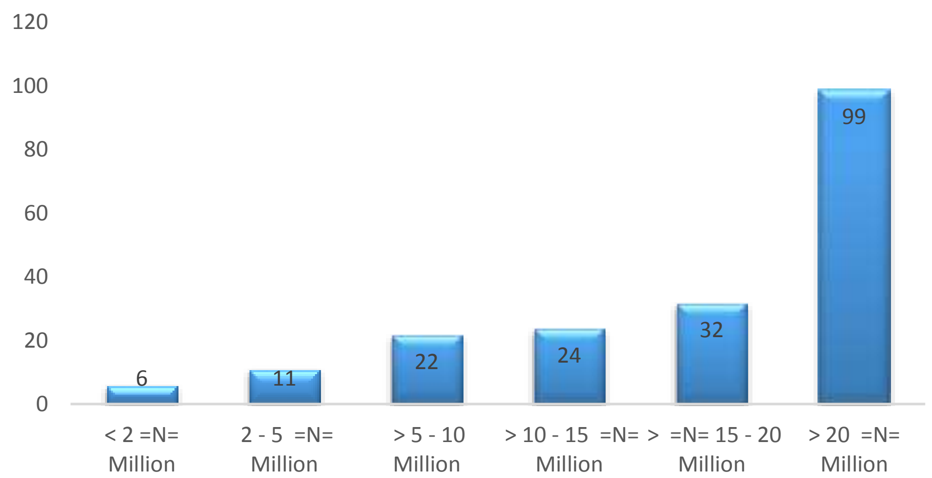

Figure 4.2: Annual Turnover of Firms 2015 - 2019

Figure 4.2 showed the average annual turnover range of the construction firm for a period of five years (2015-2019).It was revealed that the average turnover range of the construction firm for a five-year period ranged between less than 2,000,000.00 and 20,000,000.00 which indicate that the construction firms are SMEs and therefore suitable for the study.

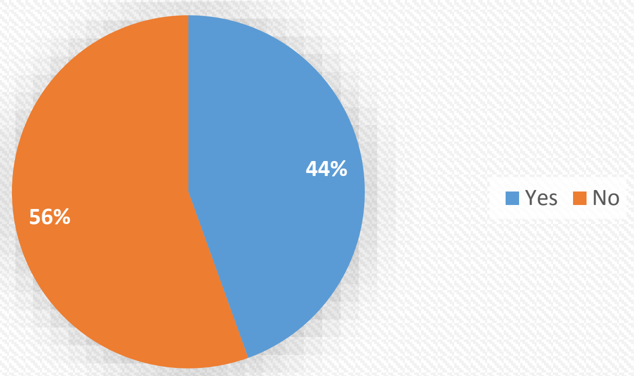

Fig. 4.3: Existence of Health and Safety Policy

Figure 4.3 revealed that most (56%) of the total population of the construction firms does not haveH&S policy. This implies that majority of the construction firms do not have H&S policy in place while the remaining 44% of the firms that have a H&S policy hardly implement it.

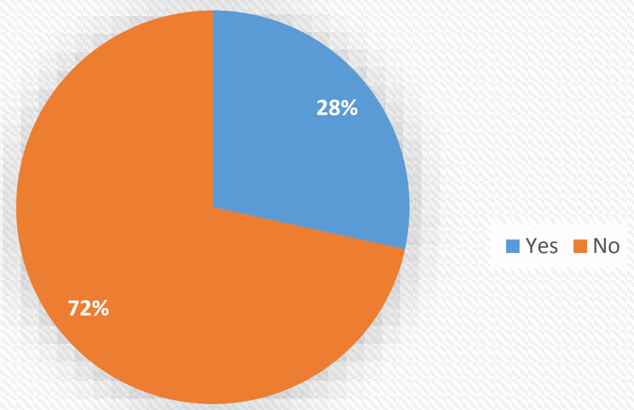

Fig. 4.4: Existence of Health and Safety Budget

Figure 4.4 revealed that 72% of the total population of the construction firms does not have a specific budget for H&S. This shows that most of the construction firms pays little or no attention to H&S in their organisations.

4.3 Results and Discussion on Implementation of Effective Safety Measures Required on Construction SMEs

The use of Mean Item Score (MIS) was employed to assess the level implementation of effective safety practices required on construction sites in Abuja. The result of the analysis is presented in Table 4.4.

Table 4.4: Implementation of Effective Safety Measures Required on Construction SMEs

S/NO	SAFETY MEASURES	MIS	RANK	DECISION
SP 1	Use of first aid kits	4.28	1st	Averagely Implemented
SP 2	Use of personal protective equipment (PPE)	3.86	2nd	Averagely Implemented
SP 19	Temporary fencing and gate house	3.53	3rd	Averagely Implemented
SP 18	Operation and maintenance manual	3.51	4th	Averagely Implemented
SP 20	Effective communication process	3.51	5th	Averagely Implemented
SP 21	Provision of adequate workers shelter	3.48	6th	Fairly Implemented
SP 5	Proper site layout planning	3.37	7th	Fairly Implemented
SP 9	Good working environment	3.33	8th	Fairly Implemented
SP 22	Provision of adequate medical facilities	3.31	9th	Fairly Implemented
SP 4	Safety personnel	3.21	10th	Fairly Implemented
SP 25	Provision of cloak and toilet	3.21	11th	Fairly Implemented
SP 3	Safety policy	3.18	12th	Fairly Implemented
SP 23	Jobsite Inspection	3.17	13th	Fairly Implemented
SP 26	Rewarding workers who demonstrate exemplary safe behaviour on site	3.15	14th	Fairly Implemented
SP 6	Health and Safety warning signs	3.13	15th	Fairly Implemented
SP 10	Welfare facilities	3.13	16th	Fairly Implemented
SP 12	Display of safety information clearly	3.13	17th	Fairly Implemented
SP 13	Use of posters and other signs to give safety education	3.12	18th	Fairly Implemented
SP 14	Safety inductions	3.11	19th	Fairly Implemented
SP 17	Provision of insurance cover for site and employee	3.07	20th	Fairly Implemented
SP 11	Keep safety procedures updated	3.04	21st	Fairly Implemented
SP 24	Fire protection programme	3.03	22nd	Fairly Implemented
SP 15	Safety meetings	3.00	23rd	Fairly Implemented
SP 8	Health and Safety training	2.96	24th	Fairly Implemented
SP 7	Health and Safety risk assessment	2.86	25th	Fairly Implemented
SP 16	Alcohol and substance abuse programme	2.85	26th	Fairly Implemented
	Average	3.25		Fairly Implemented

Source: Field survey (2021)

The first objective of the study was to assess the respondents' level of implementation of effective safety measures required on construction SMEs using some selected effective safety measures on a 5-point Likert's scale. Table 4.4 ranked and compared the MIS of the respondents with the overall MIS ranking. Five (5) averagely effective safety practices among the practices listed on construction sites according to overall mean were: use of first aid kits (1^{st},4.28), Use of PPE(2^{nd}; MIS = 3.86),Temporary fencing and gate house (3rd; MIS = 3.53), Operation and maintenance manual (4th; MIS = 3.51), and Effective communication process (5th; MIS = 3.51). The least ranked effective safety practices required on construction sites is alcohol and abuse programme which is fairly implemented (MIS = 2.85).

Analysis from Table 4.4 which highlighted the effective safety measures required on construction SMEs revealed that the averagely implemented effective safety measures required on their site(s) are; use of first aid kits, use of personal protective equipment (PPE), Temporary fencing and gate house, Operation and maintenance manual, and Effective communication process. The results show that there was average level of implementation of first aid kits and the use of personal protective equipment among the workers on construction site. This is in line with the study of Jannadi and Bu-Khamsin (2002) that researched on the key elements of safety performance in projects and identified the most significant factors to be used as first aid kits.

4.4 Results and Discussion on the Implementation of Regulations for Enhancing Effectiveness of Safety Measures

The use of MIS was also employed to rank the respondent's perception on the identified regulations for enhancing the effectiveness of safety measures on construction sites in Abuja. The result of the analysis carried out in respect of this is presented in Table 4.5

Table 4. 5: Implementation of Regulations for Enhancing Effectiveness of Safety Measures

S/NO	SAFETY REGULATIONS	MIS	RANK	DECISION
SR1	H&S Provision in Condition of Contract	4.15	1st	Most Important
SR5	National Building Code 2016	4.13	2nd	Very Important
SR6	H&S Provision in Labour, Safety & Welfare Bill 2012	3.97	3rd	Important
SR2	H&S Provision in Workmen Compensation Act	3.76	4th	Less Important
SR4	H&S Provision in Public Health Act 1990	3.74	5th	Least Important
SR3	H&S Provision in Factories Act 1990	3.47	6th	Less Important
	Average	***3.87***		***Averagely Important***

Source: Field survey (2021)

Table 4.5 presents the MIS ranking of the implementation of regulations capable of enhancing effectiveness of safety measures on SMEs in Nigeria. The five top ranked from the overall MIS among the regulations were: H&S Provision in Condition of Contrac**t** **(**MIS=4.15), closely followed by National Building Code 2016 (MIS=4.13),H&S Provision in Labour, Safety and Welfare Bill 2012(MIS=3.97), H&S Provision in Workmen Compensation Act(MIS =3.76), H&S Provision in Public Health Act 1990 (MIS=3.74). H&S provision in factories Act 1990 (MIS=3.47**)** was least ranked safety regulations capable of enhancing effectiveness of safety measures on SMEs in Nigeria which was fairly implemented. This shows that "H&S Provision in Condition of Contract" is the most averagely implemented regulations for enhancing effectiveness of safety measures.

4.5 Results and Discussion on the factors influencing the Implementation of Safety Measures by Construction SMEs

Table 4.6 gives a summary of results for the MIS ranking of the factors influencing the implementation of safety measures by construction SMEs based on the respondents' perception. The result of the analysis is presented in Table 4.6.

Table 4.6: factors influencing the Implementation of Safety Measures by Construction SMEs

S/NO	FACTORS INFLUENCING SAFETY MEASURES IMPLEMENTATION	MIS	RANK	DECISION
CS1	Low level of compliance with occupational health and safety regulations	4.21	1st	Severe
CS2	Weak national OHS standards	4.08	2nd	Severe
CS15	Poor policy implementation	4.03	3rd	Severe
CS14	Poor budgetary provision and implementation	4.02	4th	Severe
CS19	Low priority given to safety of construction workers by contractors	4.00	5th	Severe
CS9	Management commitment.	3.91	6th	Severe
CS3	Lack of adequate information on OHS	3.89	7th	Severe
CS12	Lack of enabling environment (Social, Political, Legislative, macroeconomic and bureaucratic obstacles etc.).	3.87	8th	Severe
CS11	Lack of funding for inspecting and H&S plan in a constructionsite	3.79	9th	Severe
CS21	Failure to include the safety personnel into the design of the building	3.77	10th	Severe
CS18	Shortage and wrong use of protective equipment	3.74	11th	Severe
CS22	Contractor low awareness to health and safety requirements	3.72	12th	Severe
CS13	Low capitalization	3.69	13th	Severe
CS20	Failure to report accident to appropriate authority	3.67	14th	Severe
CS10	Absence of safety representatives	3.66	15th	Severe
CS17	Absent or ineffective communication	3.57	16th	Severe
CS5	Weak legal structures	3.54	17th	Severe
CS16	Lack of organisational structure	3.51	18th	Severe
CS8	Awareness and proper medium of information dissemination.	3.50	19th	Fairly Severe
CS7	Provision of safety facilities	3.40	20th	Fairly Severe
CS23	Underpayment of the safety personnel	3.40	21st	Fairly Severe
CS4	Bribery and corruption	3.06	22nd	Fairly Severe
CS6	Beliefs	2.64	23rd	Fairly Severe
	Average	***3.68***		***Severe***

Source: Field survey (2021)

In order to determine the factors influencing the implementation of safety measures by construction SMEs, twenty-three (23) factors were identified from the literature review and ranked with the aid of MIS as shown in Table 4.6. It was shown in Table 4.6 that low level of compliance with occupational health and safety regulations (MIS = 4.21) is the most severe factor influencing the implementation of safety measures by Construction SMEs in Abuja. This was followed by Weak national OHS standards (MIS=4.08). “Poor policy implementation” (MIS=4.03) was ranked third. Otherchallenges of safety measures implementation on construction SMEs rangebetween “poor budgetary provision and implementation” (MIS = 4.02) and “beliefs” (MIS = 2.64) which are the least ranked. This result is in agreement with the findings of Nzuve and Lawrence, 2012) that low level of compliance with the implementation and examination of workplace might determine the level of compliance with the implementation of safety measures.

The above findings corroborate with the study of Smallwood and Haupt (2002) that construction industries are not concerned with the safety of their employees as their watchword; instead. This suggests the absence of management commitment to OHS in the Nigerian construction industry. In line with this, Nzuve and Lawrence (2012) also revealed that low level of inspection and examination of workplaces might determine the level of compliance with OHS regulations as evident in workplaces and this contradicts with the study of Idubor and Oisamoje (2013) which asserted that bribery and corruption are the biggest hindrances to proper compliance with occupational health and safety OHS regulations in Nigeria. The findings of this study are also in line with a study of Umeokafor *et al.* (2014) which stated that non-compliance with OHS is a major contributor to the poor state of safety implementation in construction SMEs in Nigeria.

4.6 Results and Discussion on the Effect of Implementation of Safety Measures on the Cost of Accidents

Table 4.7 presents the result on the effect of implementation of safety measures on the cost of accidents.

Table 4. 7: Effect of Implementation of Safety Measures on the Cost of Accidents

S/NO	EFFECT OF SAFETY ON ACCIDENT COST	MIS	RANK	DECISION
ESA 1	Cost of workmen's compensation	3.79	1st	Significant
ESA 5	De-motivation of workers/reduce morale	3.75	2nd	Significant
ESA 2	Payment of settlement of injury/death claims	3.67	3rd	Significant
ESA 10	Operational inefficiency/low performance	3.67	4th	Significant
ESA 15	Reduction in productivity	3.67	5th	Significant
ESA 3	Disruption of site activities	3.66	6th	Significant
ESA 12	Loss of confidence and reputation	3.66	7th	Significant
ESA 14	Increase in project cost	3.64	8th	Significant
ESA 9	Strained management-labour relationship	3.60	9th	Significant
ESA 18	Loss of life	3.58	10th	Significant
ESA 4	Time lost due to absence from work	3.56	11th	Significant
ESA 13	Expenditure on emergency equipment	3.46	12th	Fairly Significant
ESA 6	Medical payments, insurance premium	3.43	13th	Fairly Significant
ESA 11	cost of training and promotion	3.39	14th	Fairly Significant
ESA 8	Training cost for replacement	3.34	15th	Fairly Significant
ESA 16	Loss of opportunity to qualify for future tender	3.32	16th	Fairly Significant
ESA 19	Cost of investigating accident	3.31	17th	Fairly Significant
ESA 17	Damages to plant/equipment	3.28	18th	Fairly Significant
ESA 7	legal fees for defense against claims/litigation	3.23	19th	Fairly Significant
	Average	***3.53***		***Significant***

Source: Field survey (2021)

Nineteen (19) effects of implementation of safety measures on the cost of accident were identified through literature review and had been analysed using MIS as shown in Table 4.7. The analysis revealed that the most significant effect of the implementation of safety measures on the cost of accidents were "cost of workmen's compensation'' with MIS of 3.79 which was ranked first. This was followed by "De-motivation of workers/reduce morale 'which was ranked second with MIS of 3.75. "Payment of settlement of injurydeath claims' was followed by "operational inefficiency/low performance'' and "Reduction in productivity" with the same mean score of 3.67 respectively wereranked third, fourth and fifth.

It was also revealed that "Expenditure on emergency equipment'' with MIS of 3.46 which was ranked twelfth was fairly significant. The least ranked effect of the implementation of safety measures on the cost of accident is "legal fees for defense against claims/litigation "withMIS of 3.23. This is in line with the studies carried out by Agwu and Olede,2014; Smallwood *et al.*, 2009; Hinze, 2006 on the effect of Implementation of Safety Measures on the Cost of Accidents in projects and identified the most significant effect as cost of workmen's compensation, that these costs are directly related to an accident, usually covered by the workers' compensation, insurance premiums and may include hospitalisation, medical costs, liability and property losses, sick leave administration, premiums for workers and temporary disability payments. These costs are associated with the treatment of an injury and any compensation offered to injured workers and are found to have significant effect on the cost construction projects.

4.7 Results and Discussion on the Strategies for Improving the Level of Implementation of Safety Measures

The use of MIS was employed to rank the perception of respondents on the identified strategies for improving the level of implementation of safety measures of construction firms in Abuja. The result of the analysis carried out in respect of this is presented in Table 4.8.

Table 4.8: Strategies for Improving the Level of Implementation of Safety Measures

S/NO	STRATEGIES FOR IMPROVING SAFETY MEASURES IMPLEMENTATION	MIS	RANK	DECISION
STR 1	Communication of H&S policy and programs to staff	4.40	1st	Effective
STR 2	Provision of personal protective equipment	4.28	2nd	Effective
STR 4	Collective protective equipment such as scaffolding, safety nets fencing and accessibility.	4.13	3rd	Effective
STR 22	Toolbox Safety Talks	4.05	4th	Effective
STR 3	Deal with any hazards promptly	3.98	5th	Effective
STR 9	Use of Building codes of practice	3.93	6th	Effective
STR 15	Risk Awareness, management and tolerance	3.92	7th	Effective
STR 21	Accident Meetings	3.92	8th	Effective
STR 17	Safety inspection	3.89	9th	Effective
STR 7	Provide first aid supplies	3.88	10th	Effective
STR 16	Training and Enforcement	3.88	11th	Effective
STR 10	Keep safety procedures updated	3.87	12th	Effective
STR 6	Maintain comfort and cleanliness	3.79	13th	Effective
STR 18	Strategic safety communication	3.79	14th	Effective
STR 20	Safety audit	3.77	15th	Effective
STR 19	Worksite organization	3.74	16th	Effective
STR 5	Display safety information clearly	3.72	17th	Effective
STR 11	Recognition and Reward	3.67	18th	Effective
STR 13	Training and Competence	3.64	19th	Effective
STR 12	Employee engagement	3.63	20th	Effective
STR 8	Meet fire safety standard	3.62	21st	Effective
STR 23	Reward and Penalty system	3.62	22nd	Effective
STR 14	Learning organisation	3.60	23rd	Effective
	Average	***3.86***		Effective

Source: Field survey (2021)

The strategies for improving the level of implementation of safety measures were identified and, in a quest, to analyse the result, MIS was employed to rank the twenty-three (23) factors identified as shown in Table 5.8. Communication of H&S policy and programs to staff was ranked as the most effective strategies for improving the level of Implementation of Safety Measures with MIS of 4.40 followed by Provision of personal protective equipment with MIS of 4.28 while learning organization was ranked least with MIS of 3.60. This result is in agreement with the findings of Azimah *et al.* (2009) that for H&S performance to be enhanced, the H&S policy and programs to staff must be communicated on a regular basis.

4.8 Results of Inferential Analysis of Data

As a tool for the inferential statistics, factor analysis, standard multiple regression, and structural equation modelling (SEM) analysis were used.

4.8.1Exploratory factor analysis (EFA)

Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity were used to determine sampling adequacy that is suggested to check the case to variable ratio for the analysis being conducted (Field, 2013). The KMO ranges from 0 to 1 (Hoque and Awang, 2016a; Hoque and Awang, 2016b; Hoque *et al*., 2016) but the general acceptable index is a minimum value of 0.5 (Hair *et al*., 2010). Bartlett's test of sphericity should be significant at (P<0.05) for the factor analysis to be appropriate (Hair *et al*., 2010). Total variance explained was also examined as an extraction process of items to reduce them into a manageable number before further analysis. In this process, items with eigenvalues >1 are extracted into different components (Awang, 2012; Pallant, 2011).

Additionally, rotated component matrix was examined and only items with a factor loading >0.4 were retained according to the rule of thumb that if a loading is >0.4 the item is relevant for the particular component (Tabachnick and Fidell 2014; Awang, 2012).

4.8.1.1 *EFA for health and safety measures*

Table 4.9 shows Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity conducted on H&S measures, the table revealed KMO value of 0.838 as it exceeds the recommended value of 0.5 (Hair *et al*., 2010). Bartlett's Test of Sphericity significance value mustbe<0.05 for the factor analysis to be acceptable (Hair *et al*., 2010). The table revealed Bartlett's Test significance value of 0.000 which meet the required significance value of <0.05. Therefore, KMO value close to 1.0 and Bartlett's test significance value close to 0.0 suggest that data is adequate and appropriate to proceed further with factor analysis (reduction procedure).

Table 4.9: KMO and Bartlett's Test for Health and Safety Measures

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.838
Bartlett's Test of Sphericity	Approx. Chi-Square	1228.347
	Df	153
	Sig.	.000

Table 4.9 shows the total variance explained which is an extraction process of items to reduce them into a manageable number before further analysis. In this process, components with eigenvalues >1 are extracted into different components (Hoque and Awang, 2016a; Awang, 2012; Pallant, 2011). Table 4.10 revealed that the EFA has extracted five (5) components of H&S measures construct with eigen value of 5.565 for component 1, eigen value of 1.749 for component 2, eigen value of 1.334 for component 3, eigen value of 1.191 for component 4 and eigen value of 1.119 for component 5. This indicates that the items are grouped into five (5) components with total variance of 60.875% explained, exceeding the acceptable threshold of 50% (Hair *et al*., 2012).

Table 4.10: Total Variance Explained for Health and Safety Measures

Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.565	30.915	30.915	5.565	30.915	30.915	2.749	15.273	15.273
2	1.749	9.714	40.629	1.749	9.714	40.629	2.683	14.906	30.179
3	1.334	7.413	48.042	1.334	7.413	48.042	2.404	13.354	43.532
4	1.191	6.617	54.659	1.191	6.617	54.659	1.759	9.775	53.307
5	1.119	6.217	60.875	1.119	6.217	60.875	1.362	7.568	60.875
6	.851	4.730	65.606						
7	.803	4.460	70.066						
8	.785	4.363	74.429						
9	.735	4.083	78.512						
10	.634	3.521	82.032						
11	.603	3.350	85.383						
12	.532	2.957	88.339						
13	.467	2.593	90.932						
14	.394	2.189	93.122						
15	.378	2.100	95.221						
16	.330	1.831	97.052						
17	.283	1.571	98.623						
18	.248	1.377	100.000						

Extraction Method: Principal Component Analysis

Table 4.10 shows the total variance explained which is an extraction process of items to reduce them into a manageable number before further analysis. In this process, components with eigen values >1 are extracted into different components (Hoque and Awang, 2016a; Awang, 2012; Pallant, 2011). Table 4.10 revealed that the EFA has extracted five (5) components of H&S measures construct with eigen value of 5.565 for component 1, eigen value of 1.749 for component 2, eigen value of 1.334 for component 3, eigen value of 1.191 for component 4 and eigen value of 1.119 for component 5. This indicates that the items are grouped into five (5) components with total variance of 60.875% explained, exceeding the acceptable threshold of 50% (Hair *et al*., 2012).

Table 4.11 shows rotated component matrix, it revealed that the EFA extracted five components with each component, number of items and their respective factor loading. In this study, only items having factor loading >0.4 was retained (Tabachnick and Fidell 2014; Awang, 2012). The rotated component matrix shows that 18 items had factor loading >0.4 after eliminating 8 items that had loading <0.4. Therefore, component1 comprised of 5 items with factor loadings from 0.754 to 0.601, component2 comprised of 5 items with factor loadings from 0.728 to 0.609, component3 comprised of 3 items with factor loadings from 0.835 to 0.695, component4 comprised of 3 items with factor loadings from 0.806 to 0.601 and component5 comprised of 2 items with factor loadings from 0.772 to 0.520. All the 18 items were considered for further analysis under 5 components renamed as Health and safety planning (HSP), Health and safety orientation (HSO), Health and safety communication(HSC) Health and Safety Company's commitment (HSCC) and Health and safety Training and education (HSTE). Table 4.12 shows the renamed H&S measures.

Table 4.11: Rotated Component Matrix for Health and Safety Measures

	Component				
	1	2	3	4	5
Use of first aid kits	.754				
Safety policy	.748				
Health and Safety risk assessment	.681				
Safety personnel	.644				
Proper site layout planning	.601				
Fire protection programme		.728			
Provision of adequate medical facilities		.667			
Provision of insurance cover for site and employee		.634			
Rewarding workers who demonstrate exemplary safe behaviour on site		.622			
Jobsite Inspection		.609			
Safety meetings			.835		
Safety inductions			.697		
Alcohol and substance abuse programme			.695		
Temporary fencing and gate house				.806	
Use of personal protective clothing (PPE)				.612	
Provision of cloak and toilet				.601	
Keep safety procedures updated					.772
Use of posters and other signs to give safety education					.520

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 6 iterations.

Source : Researcher's analysis (2021)

Table 4.12: Renamed H&S Measures

NUMBER OF FACTORS	RENAMED H&S MEASURES
Group 1	H&S Planning
Group 2	H&S Orientation
Group 3	H&S Communication
Group 4	Company's Commitment
Group 5	H&S Training and Education

Source: Researcher's analysis (2021)

4. 8.1.2 *EFA for cost of accident*

Table 4.13 shows Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity conducted on cost of accident, the Table revealed KMO value of 0.643 as it exceeds the recommended value of 0.5 (Hair *et al*., 2010). The Table also revealed Bartlett's Test significance value of 0.000 which meet the required significance value of <0.05 (Hair *et al*., 2010). Therefore, KMO value close to 1.0 and Bartlett's test significance value close to 0.0 suggest that data is adequate and appropriate to proceed further with factor analysis (reduction procedure).

Table 4.13: KMO and Bartlett's Test for Cost of Accident

KMO Measure of Sampling Adequacy.		.643
Bartlett's Test of Sphericity	Approx. Chi-Square	327.646
	Df	36
	Sig.	.000

Source: Researcher's analysis (2021)

Table 4.14 shows the total variance explained for cost of accident**.** In this process, components with eigen values >1 are extracted into different components (Hoque and Awang, 2016a; Awang, 2012; Pallant, 2011). Table 4.14 revealed that the EFA has extracted three (3) components for cost of accident construct with eigen value of 2.254 for component 1, eigen value of 1.586 for component 2 and eigen value of 1.020 for component 3. This indicates that the items are grouped into three (3) components with a total variance of 53.994% explained, exceeding the acceptable threshold of 50% (Hair *et al*., 2012).

Table 4.14: Total Variance Explained for Cost of Accidents

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.254	25.040	25.040	2.254	25.040	25.040	1.774	19.708	19.708
2	1.586	17.623	42.663	1.586	17.623	42.663	1.570	17.440	37.148
3	1.020	11.331	53.994	1.020	11.331	53.994	1.516	16.846	53.994
4	.924	10.272	64.266						
5	.832	9.243	73.509						
6	.728	8.088	81.598						
7	.676	7.514	89.111						
8	.526	5.843	94.954						
9	.454	5.046	100.000						

Extraction Method: Principal Component Analysis

Table 4.15 shows rotated component matrix for cost of accident, the table revealed that the EFA extracted three (3) components with each component number of items and their respective factor loading. In this study, only item having factor loading >0.4 was retained (Tabachnick and Fidell 2014; Awang, 2012). The rotated component matrix shows that 9 items that had factor loading >0.4 after eliminating 9 items that had loading <0.4. Therefore, component1, 2 and 3 comprised of 3 items each with factor loadings from 0.777 to 0.636, 0.752 to 0.580 and 0.800 to 0.433 respectively. All the 9 items were considered for further analysis under 3 components renamed direct cost of Accident (HSDCA), indirect cost of Accident (IHSICA) and Proactive cost of Accident (HSPACA).

Table 4.15: Rotated Component Matrix for Cost of Accident

	Component		
	1	**2**	**3**
Cost of Workmen's compensation	.777		
Cost of hiring temporary labour	.757		
Cost of replacing damages to finished work	.636		
Cost of investigating accidents		.752	
Expenditure on emergency equipment		.733	
Production and productivity losses		.580	
Insurance and premium			.800
Medical payments			.722
Training cost for replacement			.433

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 5 iterations.

4.8.1.3 *Exploratory factoranalysis (EFA) for factors influencing the implementation of health and safety measures*

Table 4.16 shows Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity conducted on factors influencing the implementation of H&S measures, the Table revealed KMO value of 0.613 as it is greater than the recommended value of 0.5 (Hair *et al*., 2010). The significance value of Bartlett's Test of Sphericity must <0.05 for the factor analysis to be acceptable. The Table revealed Bartlett's Test significance value of 0.000 which meet the required significance value of <0.05 (Hair *et al*., 2010). Therefore, KMO value close to 1.0 and Bartlett's test significance value close to 0.0 suggest that data is adequate and appropriate to proceed further with factor analysis (reduction procedure).

Table 4.16: KMO and Bartlett's Test for factors influencing the **Implementation of Health and Safety Measures**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.613
Bartlett's Test of Sphericity	Approx. Chi-Square	248.806
	Df	55
	Sig.	.000

Table 4.17 shows the total variance explained for factors influencing the implementation of H&S measures. In this process, components with eigen values >1 are extracted into different components (Hoque and Awang, 2016b; Awang, 2012; Pallant, 2011). Table 4.17 revealed that the EFA has extracted four (4) components for factors influencing the implementation of H&S measures construct with eigen value of 2.137 for component 1, eigen value 1.724 for component 2, eigen value 1.191 for component 3 and eigen value 1.065 for component 4. This indicates that the items are grouped into four (4) components with a total variance of 55.612% explained, exceeding the acceptable threshold of 50% (Hair *et al*., 2012).

Table 4.17: Total Variance Explained for factors influencing the Implementation of Health and Safety Measures

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.137	19.428	19.428	2.137	19.428	19.428	1.709	15.540	15.540
2	1.724	15.673	35.101	1.724	15.673	35.101	1.617	14.697	30.237
3	1.191	10.829	45.931	1.191	10.829	45.931	1.611	14.646	44.883
4	1.065	9.681	55.612	1.065	9.681	55.612	1.180	10.729	55.612
5	.990	8.998	64.610						
6	.889	8.080	72.690						
7	.767	6.970	79.660						
8	.682	6.199	85.858						
9	.593	5.389	91.248						
10	.507	4.607	95.855						
11	.456	4.145	100.000						

Extraction Method: Principal Component Analysis

Table 4.18 shows rotated component matrix for factors influencing the implementation of H&S measures, the table revealed that the EFA extracted four components with each component number of items and their respective factor loading. In this study, only item having factor loading >0.4 was retained (Tabachnick and Fidell 2014; Awang, 2012). The rotated component matrix shows that 11 items had factor loading >0.4 after eliminating 12 items that had loading <0.4. Therefore, component1 comprised of 3 items with factor loadings from 0.761 to 0.643, component2 comprised of 2 items with factor loadings of 0.815 and 0.779, component3 comprised of 4 items with factor loadings from 0.743 to 0.498 and component4 comprised of 2 items with factor loadings of 0.778 and 0.674. All the 11 items were considered for further analysis under 4 components renamed: Ineffective communication, Low capitalisation, Management commitment and Weak legal structures.

Table 4.18: Rotated Component Matrix for Barriers influencing Implementation of H&S Measures

	Component			
	1	2	3	4
Bribery and corruption	.761			
Beliefs	.759			
Underpayment of the safety personnel	.643			
Low capitalization		.815		
Lack of adequate information on OHS		.779		
Failure to include the safety personnel into the design of the building			.743	
Absent or ineffective communication			.613	
Lack of organisational structure			.607	
Poor budgetary provision and implementation			.498	
Weak legal structures				.778
Low priority given to safety of construction workers by contractors				.674

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 5 iterations.

4.8.1.4 *EFA for strategies for improving implementation of safety measures*

Table 4.19 shows Kaiser-Meyer-Olkin (KMO) and Bartlett’s Test of Sphericity conducted on strategies for improving implementation of safety measures, the table revealed KMO value of 0.513, as it is greater than the recommended value of 0.5 (Hair *et al*., 2010). The significance value of Bartlett’s Test of Sphericity must <0.05 for the factor analysis to be acceptable. The table revealed Bartlett’s Test significance value of 0.000 which meet the required significance value of <0.05 (Hair *et al*., 2010). Therefore, KMO value close to 1.0 and Bartlett’s test significance value close to 0.0 suggest that data is adequate and appropriate to proceed further with factor analysis (reduction procedure).

Table 4.19: KMO and Bartlett's Test for Strategies for Improving Implementation of Safety Measures

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.513
Bartlett's Test of Sphericity	Approx. Chi-Square	167.346
	Df	36
	Sig.	.000

Table 4.20 shows the total variance explained for strategiesfor improving implementation of safety measures. In this process, components with eigenvalues >1 are extracted into different components (Hoque and Awang, 2016a; Awang, 2012; Pallant, 2011). Table 4.20 revealed that the EFA has extracted four (4) components for strategies for improving implementation of safety measures construct with eigen value of 1.911 for component 1, eigen value 1.425 for component 2, eigen value 1.114 for component 3 and eigen value 1.006 for component 4. This indicates that the items are grouped into four (4) components with a total variance of 60.628% explained, exceeding the acceptable threshold of 50% (Hair *et al*., 2012).

Table 4.20: Total Variance Explained for Strategies for Improving Implementation of Safety Measures

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.911	21.228	21.228	1.911	21.228	21.228	1.703	18.927	18.927
2	1.425	15.834	37.062	1.425	15.834	37.062	1.471	16.342	35.269
3	1.114	12.382	49.445	1.114	12.382	49.445	1.237	13.743	49.012
4	1.006	11.183	60.628	1.006	11.183	60.628	1.045	11.616	60.628
5	.981	10.904	71.532						
6	.772	8.581	80.113						
7	.760	8.448	88.562						
8	.636	7.062	95.623						
9	.394	4.377	100.000						

Extraction Method: Principal Component Analysis.

Table 4.21 shows rotated component matrix for strategiesfor improving implementation of safety measures, the Table revealed that the EFA extracted four components with each component number of items and their respective factor loading. In this study, only item having factor loading > 0.4 was retained (Tabachnick and Fidell 2014; Awang, 2012). The rotated component matrix shows that 9 items had factor loading >0.4 after eliminating 14 items that had loading <0.4. Therefore, component1 comprised of 3 items with factor loadings from 0.749 to 0.687, component2 comprised of 2 items with factor loadings of 0.862 and 0.846, component3 comprised of 2 items with factor loadings -0.831 and 0.692 and component4 comprised of 2 items with factor loadings of 0.728 and 0.666. All the 9 items were considered for further analysis under 4 components renamed: Awareness and Advocacy, Monitoring and inspection, Safety programs and Training and Education.

Table 4.21: Rotated Component Matrix for Strategies for Improving Implementation of Safety Measures

	Component			
	1	2	3	4
Training and Enforcement	.749			
Communication of H&S policy and programs to staff	.744			
Training and Competence	.687			
Risk Awareness, management and tolerance		.862		
Display safety information clearly		.846		
Deal with any hazards promptly			-.831	
Provide first aid supplies			.692	
Safety inspection				.728
Recognition and Reward				.666

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 4 iterations.

4.8.1.5 *EFA for improved safety measures implementation*

Table 4.22 shows Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity conducted on improved safety measures implementation, the table revealed KMO value of 0.803 as it exceeds the recommended value of 0.5 (Hair *et al*., 2010). The Table also revealed Bartlett's Test significance value of 0.000 which meet the required significance value of <0.05 (Hair *et al*., 2010). Therefore, KMO value close to 1.0 and Bartlett's test significance value close to 0.0 suggest that data is adequate and appropriate to proceed further with factor analysis (reduction procedure).

Table 4.22: **KMO and Bartlett's Test for Improvedsafety measures**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.803
Bartlett's Test of Sphericity	Approx. Chi-Square	664.476
	Df	78
	Sig.	.000

Table 4.23shows the total variance explained for improved safety performance**.** In this process, components with eigen values >1 are extracted into different components

(Hoque and Awang, 2016a; Awang, 2012; Pallant, 2011). Table 5.23revealed that the EFA has extracted four (4) components for improved safety performance with eigen value of 4.130 for component 1, eigen value of 1.262 for component 2, eigen value of 1.177 for component 3 and eigen value of 1.024 for component 4.

This indicates that the items are grouped into three (3) components with a total variance of 58.404% explained, exceeding the acceptable threshold of 50% (Hair *et al*., 2012).

Table 4.23: Total Variance Explained for Improved safety measures

	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.130	31.771	31.771	4.130	31.771	31.771	2.656	20.434	20.434
2	1.262	9.707	41.478	1.262	9.707	41.478	1.937	14.900	35.334
3	1.177	9.051	50.529	1.177	9.051	50.529	1.643	12.640	47.973
4	1.024	7.876	58.404	1.024	7.876	58.404	1.356	10.431	58.404
5	.924	7.105	65.509						
6	.879	6.760	72.270						
7	.767	5.901	78.170						
8	.611	4.696	82.867						
9	.584	4.490	87.357						
10	.528	4.060	91.417						
11	.384	2.950	94.367						
12	.376	2.891	97.259						
13	.356	2.741	100.000						

Extraction Method: Principal Component Analysis.

Table 4.23shows rotated component matrix for strategies for improving implementation of safety measures, the Table revealed that the EFA extracted four components with each component number of items and their respective factor loading. In this study, only item having factor loading >0.4 was retained (Tabachnick and Fidell 2014; Awang, 2012). The rotated component matrix shows that 13 items had factor loading >0.4 after eliminating 11 items that had loading <0.4. Therefore, component1 comprised of 6 items with factor loadings from 0.753 to 0.501, component2 comprised of 3 items with factor loadings from 0.811 to 0.636, component3 comprised of 2 items with factor loadings 0.843 and 0.796 and component4 comprised of 2 items with factor loadings of 0.808 and 0.729. All the 13 items were considered for further analysis under 4 components renamed: Leading indicators, Safety programs, Proactive indicators and Safety awareness.

Table 4.24: Rotated Component Matrix for Improved safety measures

	Component			
	1	2	3	4
Provision of adequate medical facilities	.753			
Provision of adequate workers shelter	.707			
Management talk about safety	.657			
Jobsite Inspection	.621			
Rewarding workers who demonstrate exemplary safe behaviour on site	.510			
Effective communication process	.501			
Assuring a tidy site		.811		
Good working environment		.726		
Appointing safety representatives		.636		
Safety meetings			.843	
Safety inductions			.796	
Use of first aid equipment				.808
Use of personal protective equipment (PPE)				.729

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 6 iterations.

4.9 Hypotheses Testing

The paths of the conceptual model which had been earlier hypothesised was analysed using regression analysis to show the extent to which the variables change together and also show its strength.

H1: There is a direct relationship between barriers influencing the implementation of H&S Measures and the strategies for improving the implementation of Safety measures.

Table 4.25 shows the regression results between the challenges of H&S measures implementation and the strategies for improving the implementation of Safety measures. Challenges of H&S Implementation were made dependent variables while

Strategies for improving safety measure were made independent variable. The subsequent related regression coefficients were statistically tested to see if they could be claimed to be significantly non-zero given in the available information in the surveyed data. The model statistically predicted the relationship between the challenges affecting H&S implementation and strategies for improving safety measures implementation, the result had a predictive power 3.6% (R=0.189, R^2= 0.036,F change = 1.891) with a P value of 0.113 > 0.05.All the four(4) variables Awareness and Advocacy, P(0,377) > 0.05, Monitoring and inspection(0.845)> 0.05,Safety programs ,P(0.66) > 0.05 and finally Training and Enforcement P(0.55)> 0.05 do not added statistically significantly to the prediction. This implies that increase in the variables of the factors influencing H&S implementation will lead to increase in the combination of improving safety measures which will in turn lead to lack of improvement in the safety performance. This proves that the combination of the variables is not good enough. Based on these, hypothesis H1 was rejected.

Table 4.25: Results of Regression Analysis between factors constraining **H&S Measures and Strategies for Improving the Implementation of Safety Measures**

Independent Variables Strategies	**Dependent variable Challenges**
Awareness and advocacy	0.072
Monitoring and inspection	-0.017
Safety program	-0.192
Training & enforcement	0.194
R	0.189
R^2	0.036
ΔF	1.891

H2: There is relationship between factors influencing the ***implementation of H&S measures and cost of accident.***

Table 4.26 shows the regression result between factors influencing the implementation of H&S measures and cost of accident. To explore the relationships, multiple regressions were carried out. The model had a predictive power of 5.5% (R=0.301; R^2 =0.55; F change =0.525 with P value of 0.018). Two of the variables had p values less than 0.05. Low capitalisation, P value (0.041) and Management commitment, P value (0.014) while the other two variables Ineffective communication had a P value of 0.331 and weak legal structures with a P value of 0.718. Based on these, hypothesis (H2) was accepted. This implies that the increase of the factors influencing safety measures implementation such as low capitalisation and lack of management commitment will increase the cost of accident in the construction SMEs such as Cost of workmen's compensation and De-motivation of workers/reduce morale.

Table 4.26: Results of Regression Analysis between factors constraining H&S Measures and Cost of Accidents

Independent Variable Barriers	Dependent Variable Cost of Accidents
Low capitalization	0.06
Management commitment	0.099
Ineffective communication	-0.024
Weak legal structures	0.003
R	0.301
R^2	0.055
ΔF	0.525

H3: ***There is a direct relationship between*** factors influencing the ***implementation of H&S measures and H&S measures.***

Regression analysis was carried out to predict the degree of effect of challenges of H&S

On the Safety measures required on the construction SMEs. Multiple Regression was run to predict the relationship between the two variables.The model statistically significantly predicted (R=0.254; R^2 =0.244(24%); F change =0.689 with P value of 0.46). Out of the five(5) variables of H&S Measures, four(4)namely H&S Communication, H&S Company's commitment, H&S Orientation, Training and

Education have P values of less than 0.05 with only the fifth variable H&S Planning having P value greater than 0.05.Based on these, hypothesis (H3) was rejected.

The relationship was thus significant. This implies that the factors influencing the H&S measures implementation have effect on the level of the implementation of the safety measures on construction SMEs. This means that the more factors influencing the safety measures implementation, the more safety measures implementation on construction SMEs will be affected which will retard the safety performance of the SMEs. Hence attention need to be given to safety measures implementation on construction SMEs. See Table 4.27 for a summary of the result.

Table 4.27: Results of Regression analysis between factors influencing the **safety measures Implementationof H&S Measures and the H&S Measures**

Independent Variable	Dependent Variable (Challenges)
H&S communication	.058
H&S company's commitment	-.082
H&S orientation	.009
Training and education	-.108
H&S planning	-.035
R	.254
R^2	.244
ΔF	.689

H4: ***There is relationship between cost of accident and strategies for improving implementation of safety measures***.

Table 4.28 shows the regression result between cost of accident and strategies for improving implementation of safety measures. The model had a predictive power of 40% (R=0.201; R^2 =0.40; F change =2.342 with P value of 0.03). Three (3) out of the four (4) variables had p values less than 0.05. The variables are HSIAA, P value (0.000); HSISMI P value (0.031); HSISP P value (0.018). Only HSISTE had a p value of 0.047 > 0.05. Based on these the hypothesis H4 was accepted. This implies that increase in cost of accidents on construction SMEs will automatically contribute to an increase in the application of the strategies that will be adopted for improving the implementation of safety measures which will decreases the chance of safety measures implementation and hence safety performance on construction SMEs.

Table 4.28: Results of Regression Analysis between Cost of Accidents and Strategies for Improving the Implementation of Safety Measures

Independent Variable Strategies	Dependent Variable
Awareness and advocacy	.141
Monitoring and inspection	.066
Safety programs	-.178
Training and education	-.064
R	.209[a]
R^2	.040
ΔF	2.342

H5: ***There is relationship between cost of accident and H&S Measures***

Table 4.29 indicates that the model summary shows that a combination of the H&S measures (H&S Planning, H&S Orientation, H&S Communication, Company's Commitment, H&S Training and Education) explains only 9% (R = 0.09) variance in the dependent variable which is Cost of Accidents. However, the coefficient of determination (R^2) observed was 8% (R^2=0.08) which also indicates a weak strength of relationship between a combination of the H&S measures and cost of accidents. F changes=1.72 and p value=1.88 which were greater than 0.05 implying that the relationship was statistically non-significant and the hypothesis H5 was thus rejected. This implies that improvement in H&S measures will lead to decrease in cost of accident and thereby increase the safety performance. Assaf *et al.* (2001) argue that poor health and safety implementation will increase H&S cost, it also increases the ultimate uncertainty in the cost of welfare and employee's health and safety.

Table 4.29: Results of Regression Analysis between Cost of Accidents and H&S Measures

Independent Variable (H&S measures)	Dependent Variable Cost of accident
H&S communication	.064
H&S company's commitment	-.035
H&S orientation	.005
Training and education	-.213
H&S planning	-.249
R	.091[a]
R^2	.08
ΔF	1.723

H6: ***There is relationship between strategies for improving implementation of safety measures and safety Measures.***

Table 4.30 shows the result of the regression analysis between strategies for improving implementation of safety measures and improved safety measures. The summary of the model of the regression shows the predictive effect of strategies for improving implementation on improved safety measures. The model had a very low predictive value of 11% (R=0.09; R^2=0.11; f change = 2.28 with P value 0.132). The models had p values greater than 0.05 which implies that a negative combination of strategies used for the implementation of safety measures will affect the level of safety measures implementation on construction SMEs and thereby affecting the project performance.

Table 4.30: Results of Regression analysis between Strategies for Improving Implementation of Safety Measures and Improved Safety measures

Independent Variable (Improved Safety Measures)	Dependent Variable (Strategies)
Leading indicators	.028
Proactive indicators	.497
Safety awareness	.058
Safety programs	.232
R	.009[a]
R^2	0.11
ΔF	2.28

H7: There is relationship between cost of accident and safety measures.

To explore the relationships, multiple regressions were carried out Table 4.31. This statistically implies fitting the following MLR and testing whether the related regression coefficients were significantly different from zero. The model had a predictive value of 19% (R=0.34; R^2=0.19; f change = 1.87 with P value 0.173). It was also shown from the analysis that the independent variables have no significant relationship with improved safety measures implementation ($p > 0.05$). Based on these, hypothesis (H7) was rejected.

Table 4.31: Results of Regression Analysis between Cost of Accidents and Improved Safety measures

Independent Variable (Cost of accident)	Dependent Variable (Safety performance)
Direct cost of accidents	-.086
Indirect cost of accident	-.210
Proactive cost of accident	.104
R	.190[a]
R^2	.034
ΔF	.18

H8: ***There is positive relationship between H&S Measure's implementation and improved safety.***

Regression analysis was carried out to predict the degree of effect of challenges of H&S on the Safety measures required on the construction site. Multiple Regression was run to predict the relationship between the two variables. The model statistically significantly predicted (R=0.914; R^2 =0.836 (844%); F change =0.525 with P value of 0.018). All the five (5) variables of H&S Measures, four (4) namely H&S Communication, H&S Company's commitment, H&S Orientation and Training and Education and H&S Planning have P values of less than 0.05 which is the threshold of significance. The relationship was significant. Based on these Hypothesis H8 was accepted. Table 4.32 shows the regression result between H&S measures implementation and improved safety measures.

Table 4.32: Result of regression Analysis between H&S measures implementation and improved safety measures

Independent Variable (H&S measures)	Dependent Variable (Safety performance)
H&S communication	.740
H&S company's commitment	.478
H&S orientation	.252
Training and education	-.166
H&S planning	.391
R	.914
R^2	.836
ΔF	.209

From Table 4.32, the summary of the model of the regression shows the predictive effect of H&S measures on improved safety measures. The model had a very predictive value of 84% (R=0.914; R^2=0.836; f change = 1.06 with P value 0.00).The relationships all showed to be significant. Furthermore, the result showed a significant relationship between H&S Measures and improved safety measures. All relationships were significant having p values less than 0.05 which is the mark for significance. This implies that when there is an improvement in the H&S Measures implementation here would be an improvement in safety performance. Popov *et al.* (2016) asserted that H&S measures have direct relation with improved safety measures implementation.

H9: ***There is an indirect relationship between factors influencing the implementation of H&S measures and Improved safety performance***

Table 4.33shows the regression result between factors influencing H&S measures and safety measures implementation. The model had a predictive value of 45% (R=0.672; R^2=0.452; f change = 33.624 with P value 0.09). Models had P values less than 0.05 showing that they all had significant relationships. Based on these the hypothesis H 9 was accepted.

Table 4.33: Results of Regression Analysis between factors influencing the H&S Measures and Improved Safety measures

Independent Variable	Dependent Variable
Low capitalization	-.478
Management commitment	-.140
Ineffective communication	.052
Weak legal structures	.066
R	.672[a]
R^2	.452
ΔF	33.624

4.10 Summary of the Regression Analysis

From all regression analysis carried out to explore the relationships between the constructs, the following were obtained. The relationship between the challenges variables and strategies had P values of 1.811which is greater than 0.05. This relationship was thus said to be not significant and hypothesis H1 was thus rejected. The relationship between challenges and cost of accidents had P value of 0.018 in the explored relationships which was lower than 0.05 and the relationship was thus said to be significant and the hypothesis H2 was accepted. When the relationship between challenges and health and safety measures was explored, the P value obtained was 0.46, the relationship was said to be non- significant and hypothesis H3 was rejected. For the relationship between cost of accidents and strategies, the models had p value of 0.03 less than 0.05 and this relationship was said to be significant; the hypothesis H4 was thereby accepted.

In exploring the relationship between cost of accidents and H&S measures the models had P value of 1.88which were greater than 0.05 implying that the relationship was statistically non-significant and the hypothesis H5 was thus rejected. The relationship between strategies and improved safety measures had p value of 0.132 which is greater than 0.05. The relationship was thus said to be non-significant and the hypothesis H6 was rejected. After exploring the relationship between cost of accident and improved safety measures, the relationship had a p value of 0.173 which is greater than 0.05. The relationship was also said to be non-significant and hypothesis H7 was rejected. The relationship between health and safety measures and improved safety measures had p value of 0.018. Based on this, the relationship was said to be significant and hypothesis H8 was accepted. In exploring the relationship between challenges of safety measures and improved safety measures, the relationship had p value of 0.00 in the model. The relationship was said to be significant and hypothesis H 9 was accepted.

In summary the analyses implies that improvement in H&S measures will lead to decrease in cost of accident and thereby increase the safety performance. Assaf *et al.* (2001) argued that poor health and safety measures will increase H&S cost, it also increases the ultimate uncertainty in the cost of welfare and employee's H&S,similarly when there is an improvement in the H&S Measures there would be an improvement in safety performance. Ghousi *et al.* (2018) asserted that H&S measures has direct relation with improved safety measures implementation. See Table 4.34 for the summary of the results of the regression analysis. The results from the regression statistics showed a low predictive value; hence regression had a low predictive ability. Therefore, a higher analytical technique (PLS – SEM) was chosen to gives a higher predictive power as compared to regression analysis and can also be used to validate the model whereas regression analysis cannot.

Table 4. 34: Summary of Regression analysis

Hypothesis	Path relationship	Decision
H1	Challenges → Strategies	Rejected
H2	Challenges → Cost of Accident	Accepted
H3	Challenges → H&S Measures	Rejected
H4	Cost of Accident → Strategies	Accepted
H5	Cost of Accident → H&S Measures	Rejected
H6	Strategies →Improved safety measures	Rejected
H7	Cost of Accident → Improved safety measures	Rejected
H8	H&S Measures → Improved safety measures	Accepted
H9	Challenges → Improved safety measures	Accepted

4.11 Development of Partial Least Square - Structural Equation Model Analysis

Partial Least Square - Structural Equation Model **(**PLS-SEM)usually follows a two sets of linear equations process known as the measurement model and structural model (Henseler *et al.,*2009). The measurement model (the outer model) specifies the relationships between latent variables, while the structural model (the inner model) specifies the relationships between a latent variable (construct) and its manifest variables (indicators).

According to Henseler *et al.* (2009), PLS algorithm is essentially a sequence of regressions in terms of weight vectors and its basic algorithm involves iterative estimation of latent variable scores, estimation of outer loading and path coefficients. In this study, the model validation was assessed using two step processes as mention earlier(the assessment of the measurement model and the assessment of the structural model). However, the aim of model validation is to determine whether both the measurement and the structural model meet the quality criteria for experiential study (Urbach and Ahlemann, 2010).

Smart PLS 3.3.2vwas used in assessing the measurement and structural model. Thi statistical software assessed the psychometric properties of the measurement model and estimates the parameters of the structural model. Table 4.35and Figure 4.5show the list of constructs, indicator variables and indicator coding used in the model.

Table 4.35: Constructs, Indicator Variable and Indicator Coding used in the Model

Construct	Indicator variable	Indicator Coding
Barriers influencing the implementation of H&S measures	Ineffective Communication	HSCIC
	Low capitalization	HSCLC
	Management commitment	HSCMC
	Weak legal structures	HSCWLS
Cost of accident	Direct cost of Accident	HSDCA
	Indirect cost of Accident	HSICA
	Proactive cost of Accident	HSPACA
H&S Measures	H&S Communication	
	H&S Company's Commitment	HSCC
	H&S Orientation	HSO
	H&S Training&Education	HSTE
	H&S Planning	HSP
Strategies for improving implementation of safety measures	Awareness and Advocacy	HSISAA
	Monitoring and Inspection	HSISMI
	Safety programs	HSISSP
	Training and Enforcement	HSISTE
Improved safety measures implementation	Leading indicators	ISLI
	Safety programs	ISP
	Proactive indicators	ISPI
	Safety awareness	ISW

The list of constructs and indicator variables was obtained as a result of item reduction analysis carried out to make sure that only prudent, functional, and internally consistent items are ultimately included for further analysis. Therefore items that are not or are the least related to the constructs are being eliminated. Firstly, Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity was conducted on five (5) constructs (Barriers, Cost of accidents, H&S Measures, Strategies and Improved safety measures implementation) to guarantee sampling adequacy and the significant level required to perform further analysis (Field, 2013). The KMO was assessed using the approach recommended by Tabachnick and Fidell (2014); Hair *et al* (2010); Pallant (2011) that the KMO value ranged between 0 and 1, with minimum value of 0.5, to indicate the sample is adequate and Bartlett's test of sphericity is significant at ($p<0.005$). KMO values of all the five (5) constructs are above the minimum value of 0.5., while the Bartlett's test of sphericity are all significant at ($p=0.000$). Hence, the two tests indicate that the sampling are adequate and can be considered for further analysis. Figure 4.5 shows the Initial theoretical Model with all indicators.

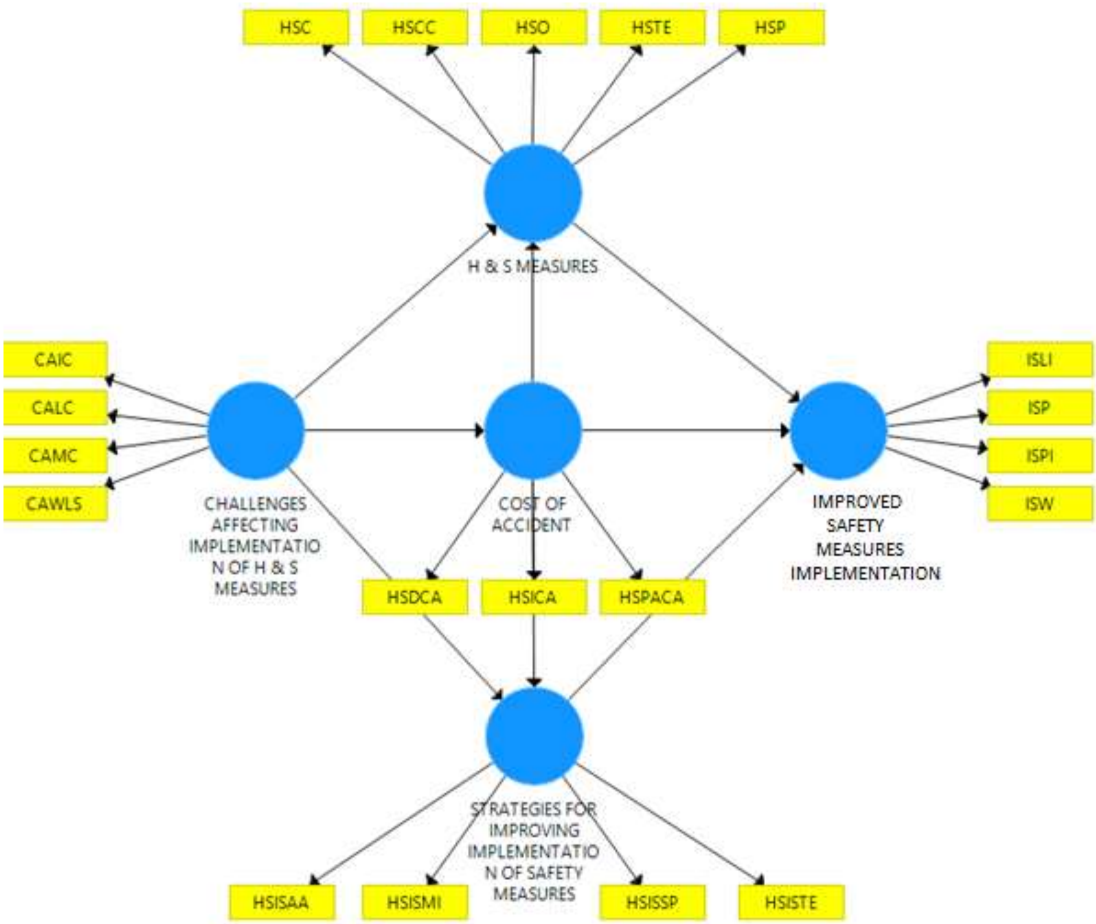

Figure 4.5.: **Initial Theoretical Model with all Indicators**

Source: Author (2022)

4.12 Assessment for Measurement Model

Measurement model was assessed by examining indicator's reliability, composite reliability (CR), convergent validity and discriminant validity (Hair *et al*., 2014; Hair *et al*., 2017).

4.12.1 Indicator reliability

The indicator reliability assessed the level in which an indicator is consistent with what it intends to measure (Urbach and Ahlemann, 2010). In order to test for the indicator reliability of the constructs, factor loadings were examined as show in table 5.26 with factor loadings of >0.7. However, it is suggested that factor loadings should be >0.5 for better results (Truong and McColl, 2011). Therefore, this study adopted factor loading ≥0.7 as its threshold. Henseler *et al.* (2009) suggested that caution should be taken when deciding to eliminate an indicator, indicator should only be eliminated when its loading is lower 0.7. Therefore, seven (7) indicators had loading less than the acceptable threshold of ≥0.7 set for this study. These indicators include HSCMC, HSPACA, HSCC, HSISAA, HSISSP, HSCWLS and ISP. The process was re-run repeatedly after elimination of each indicator.

4.12.2 Composite reliability (CR)

Composite reliability (CR) describes the degree to which indicators indicate the constructs or measures the reliability of internal consistency. According to Faul*et al.*,(2009) composite reliability values between 0.60 and 0.70 are acceptable in exploratory research while, in more advanced research stages, values between 0.70 and 0.90 are considered satisfactory. Table 4.36 show that all the CR values for all constructs exceeded the suggested value threshold of 0.70 (Hair *et al*. (2013) and convergent validity which involves the degree to which individual indicator reflect a construct converging in comparison to items measuring different constructs.

4.12.3 Convergent validity

Convergent validity was assessed using the value of average variance extracted (AVE). The AVE value measures the proportion of the variance explained by the construct in such a way that a value of 0.50 or higher indicates that, on average, the construct explains more than half of the variance of its indicators, while an AVE of less than 0.50 indicates that, on average, there are errors in the items other than the variance explained by the construct. Convergent validity is considered acceptable when the AVE value of a construct is ≥0.5 (Hair *et al*., 2017). Table4.36 showsthat all the AVE values exceeded the suggested value of 0.5

Table 4.36: **Constructs Reliability**

Constructs	Indicator	Factor Loadings	CR	AVE
Challenges affecting implementation of H&S measures	HSCIC	0.794	0.812	0.684
	HSCLC	0.859		
Cost of accident	HSDCA	0.856	0.822	0.698
	HSICA	0.815		
H&S Measures	HSC	0.799	0.874	0.633
	HSO	0.798		
	HSTE	0.797		
	HSP	0.790		
Strategies for improving implementation of safety measures	HSISMI	0.844	0.865	0.762
	HSISTE	0.902		
Improved safety measures implementation	ISLI	0.822	0.827	0.615
	ISPI	0.795		
	ISW	0.732		

4.12.4 Discriminant validity

Discriminant validity was used to differentiate constructs from one another and also measures the degree of difference between overlapping constructs (Hair *et al*., 2014). Unlike convergent validity, discriminant validity tests whether the items unintentionally measure something else besides the intended construct. In PLS-SEM, there are three measures of determining discriminant validity (Cross loadings, Fornell-

Larcker's criterion and the Heterotrait-Monotrait (HTMT) ratio) (Henseler *et al*., 2016; Hair *et al*., 2019).

Cross loading was assessed by correlating each constructs indicators scores with other indicators. If each factor loading is higher for its designated construct compared to any other constructs, then it can be inferred that the different constructs items are not interchangeable. Table 4.37 shows that factor loading on each designated constructs was higher than in any other constructs.

Table 4.37.: Cross-Loadings

	Cost of accident	H & S measures	Improved safety performance	Challenges affecting implementation of h & s measures	Strategies for improving implementation of safety measures
HSDCA	**0.856**	-0.151	-0.139	0.467	0.262
HSICA	**0.815**	-0.08	-0.084	0.346	0.363
HSC	-0.021	**0.799**	0.761	-0.212	0.022
HSO	-0.089	**0.798**	0.787	-0.217	-0.124
HSTE	-0.07	**0.797**	0.667	-0.22	-0.108
HSP	-0.27	**0.790**	0.681	-0.237	-0.255
ISLI	-0.163	0.748	**0.822**	-0.223	-0.081
ISPI	-0.105	0.694	**0.795**	-0.149	-0.202
ISW	-0.044	0.705	**0.732**	-0.186	0.017
HSCIC	0.409	-0.175	-0.176	**0.794**	0.203
HSCLC	0.405	-0.278	-0.215	**0.859**	0.307
HSISMI	0.255	-0.141	-0.153	0.255	**0.844**
HSISTE	0.381	-0.115	-0.057	0.289	**0.902**

Fornell-Larcker's criterion requires a construct to share more variance with its assigned items than with any other construct. This method compares the square root of the average variance extracted (AVE) with the correlation of constructs. A construct should explain the variance of its own indicator rather than the variance of other constructs. Therefore, the square root of each constructs AVE should exceed the correlations with other constructs (Hair *et al*., 2014).

In applying this method, Table4.36 revealed that the square root of AVE of each of the constructs was greater than its correlation with other constructs. The diagonal (bold) values are the square root of the average variance extracted (AVE) of each construct (Al-Gahtani *et al.*, 2007; Wong, 2013). Table 4.36 shows that all the diagonal (bold) values measured are high above its corresponding correlation coefficients. Discriminant validity of above 50% variance is adequate (Chin, 2010).

Table 4.38 Fornell-Larcker's Criterion

	Challenges affecting implementation of H&S measures	Cost of accident	H&S measures	Improved safety performance	Strategies for improving implementation of safety measures
Challenges affecting implementation of H&S measures	**0.827**				
Cost of accident	0.490	**0.836**			
H&S measures	-0.278	-0.140	**0.796**		
Improved safety performance	-0.238	-0.135	0.312	**0.784**	
Strategies for improving implementation of safety measures	0.313	0.370	-0.144	-0.114	**0.873**

Heterotrait-Monotrait (HTMT) ratio approach shows the estimation of the true correlation between two constructs. An HTMT value <1should be achieved, preferably a value of 0.90 and below. Value >0.90 depicts a lack of discriminant validity (Henseler *et al*., 2015; Franke and Sarstedt, 2019). Table 4.39 also revealed that all the assessed constructs meet the criterion as they all have a ratio <0.90.

Table 4.39: Heterotrait-Monotrait (HTMT) Ratio

	Challenges affecting implementation of H&S measures	Cost of accident	H&S measures	Improved safety performance	Strategies for improving implementation of safety measures
Challenges affecting implementation of H&S measures					
Cost of accident	0.878				
H&S measures	0.414	0.238			
Improved safety performance	0.386	0.245	0.823		
Strategies for improving implementation of safety measures	0.501	0.586	0.219	0.219	

The results from both the Fornell-Larcker's criterion and HTMT revealed an acceptable discriminant validity level and attained a satisfactory quality level of the measurement model.

4.13 Validation of the Model

This section presents analyses undertaken to assess the structural model, Collinearity issue, structural model path coefficients/hypothesis testing, coefficient of determination, effect of size, predictive relevance and goodness of fit of the model.

4.13.1 Assessment for structural model

The structural model (inner model) consists of exogenous (independent) and endogenous (dependent) constructs as well as the relationships between them (Henseler *et al*., 2016). This involves examining the model's predictive capabilities and the relationships between the constructs. The purpose of structural model is to demonstrate how independent and dependent constructs are linked, to identify the variance explained by one or more constructs in the model and to establish the significance level of all paths produced from the model (Chin, 2010;Ringle*et al.*, 2019).

The values of exogenous (independent) constructs are assumed to be given from outside the model. Hence, independent variables are not explained by other constructs in the model and there must not be any arrows in the structural model that point to independent constructs. On the contrary, the endogenous (dependent) constructsare explained by other constructs in the model. Each dependent constructs must have one or more arrow of the structural model pointing to it (Henseler *et al*., 2016).

Structural model was assessed once after the measurement model was successfully validated. According to statistical research, structural model validation in PLS-SEM involved a five (5) steps procedure (assessing the structural model for Collinearity issue, assessing the relevance and significance of structural relationships expressed in the model, assessing coefficient of determination (R^2), assessing the effects size (f^2) and assessing the predictive relevance (Q^2).

4.13.2 Collinearity issue

Assessing detection of Collinearity issues the first step while evaluating the results of structural model. Collinearity is the degree of high correlation among one predictor (construct) and a set of other predictors (constructs) (Hair *et al*., 2014). In order to assess Collinearity problems among the constructs in the model, variance inflation factor (VIF) was used.VIF value of 5 or above indicates a potential Collinearity problem (Hair *et al*., 2014).The algorithm was run and the Collinearity diagnostic was observed in Table 5.40, which shows the VIF tolerance values for structural model. The results of Collinearity assessment indicate that the constructs satisfied the tolerance values for VIF. Therefore, the structural model does not present Collinearity problems.

Table 4.40: Collinearity Issue (VIF)

	Challenges affecting implementation of H&S measures	Cost of accident	H&S measures	Improved safety performance	Strategies for improving implementation of safety measures
Challenges affecting implementation of H&S measures		1.000	1.316		1.316
Cost of accident			1.316	1.170	1.316
H&S measures				1.031	
Improved safety performance					
Strategies for improving implementation of safety measures				1.171	

4.13.3 The structural model path coefficients/hypothesis testing

The next step is assessing the relevance and significance of the structural relationships involved in the model. In examining the relationship between two constructs, the path coefficients and significance are verified. The Path coefficients should be greater than 0.100 to account for some impact within the model and to be significant at the 0.05 level of significance (Huber *et al.*, 2007). The following path coefficients are represented as follows and shown below.

Challenges of H&S measures→ Strategies H1

Challenges of H&S measures→ Cost of accident H2

Challenges of H&S measures→H&S measures…………………….................H3

Cost of accident Strategies……………………………………….......... H4

Cost of accident→ H&S Measures..H5

Strategies → Safety measures..H6

Cost of accident → Safety measures……………………………………….....H7

H&S Measure’s → Safety measures..H8

Challenges →Safety measures... H9

SmartPLS algorithm bootstrap analysis was conducted to evaluate their statistical significance. A bootstrapping procedure of 500 to generate the t-values and in order to test for the significance of the path coefficients a two-tailed test was computed at a significance level of 0.01. The values for the path coefficients are usually between -1 and +1, indicating a strongly negative and strongly positive relationship between the constructs. Values close to 0 present a weak relationship. The rule of thumb is that t-value greater than 1.65, 1.96 and 2.57 are considered to be significant at $p \leq 0.10$, $p \leq 0.05$ and $p \leq 0.01$ level respectively (Nandakumar, 2008).

Table 4.41 shows the path coefficients, t-value, and significance level (p-value) for all hypothesized relationships in the model. Using the results from the path assessment, each proposed hypothesis either Significant or not Significant is presented in Table4.41However, maximum six (6) of the paths (H1, H2, H3, H4, H8 and H9) were strongly significant and only three (3) paths (H5, H6 and H7) did not meet the required value of the rule of thumb.

Table 4.41: Structural Model Path Coefficient/Hypothesis Testing

Hypothesis	Path	Original sample (o)	Sample mean (m)	Standard deviation (stdev)	T statistics (|o/stdev|)	P values	Remark
	Direct relationship						
H1	Challenges affecting implementation of H&S measures →Strategies for improving implementation of safety measures	0.172	0.176	0.078	2.211	0.027	Supported
H2	Challenges affecting implementation of H&S measures →Cost of accident	0.49	0.493	0.066	7.45	0	Supported
H3	Challenges affecting implementation of H&S Measures →H&S measures	-0.277	-0.278	0.073	3.811	0	Supported
H4	Cost of accident →Strategies for improving implementation of safety measures	0.286	0.29	0.082	3.5	0.001	Supported
H5	Cost of accident → H&S measures	-0.002	-0.001	0.079	0.029	0.977	Not supported
H6	Strategies for improving implementation of safety measures → Improved safety implementation	0.024	0.023	0.032	0.762	0.446	Not supported
H7	Cost of accident →Improved safety implementation	-0.017	-0.015	0.031	0.54	0.59	Not supported
H8	H&S Measures →Improved safety measures implementation	0.916	0.916	0.014	65.665	0	Supported
	Indirect relationship						
H9	Challenges affecting implementation of H&S measures →Improved safety measures implementation	-0.255	-0.255	0.065	3.936	0	Supported

4.13.4 Coefficient of determination (R^2)

The third step is assessing each dependent constructs coefficient of determination (R^2) which measures the relationship of a constructs explained variance to its total variance. It is suggested that R^2 for endogenous constructs should be greater than 0.1(Falk and Miller, 1992). However, interpreting R^2 value is based on research discipline, in general the R^2 values considered are 0.75, 0.50 or 0.25 and endogenous constructs can be described as substantial prediction, moderate prediction and weak prediction, respectively(Hair *et al*., 2017). On the other hand, Ritchey (2008) establish that, in social sciences, R^2 values from 0.04 to 0.16 can be described as moderately weak and from 0.25 to 0.49 are considered moderately strong.

Considering this criteria, PLS-SEM algorithm gave weak values for H&S measures 0.077 (7.7%) and strategies for improving implementation of safety measures0.160 (16%). While cost of accident 0.282 (28.2%) and improved safety measures implementation 0.834 (83.4%) got a moderately strong value. In addition, they all complied with Falk and Miller (1992) rule by being above 0.1. However, the improved safety measures implementation construct was considered the strongest, explaining 83.3% of the variance.

This implies that the overall safety measures implementation had an R^2 of 0.834,this means 83.4% of the safety measures implementation were influenced by strategies for improving safety measures while other factors not considered in the PLS- SEM Analysis are required for the variation left unexplained by the three(3) explanatory variables within the model See Figure 4.6 and Figure 4.7 for the structural model with path coefficients and R^2 and structural model with t-values respectively with respect to these discussions, It show each construct had the power to predict the validation of structural models and the significance of each path coefficients in the model.

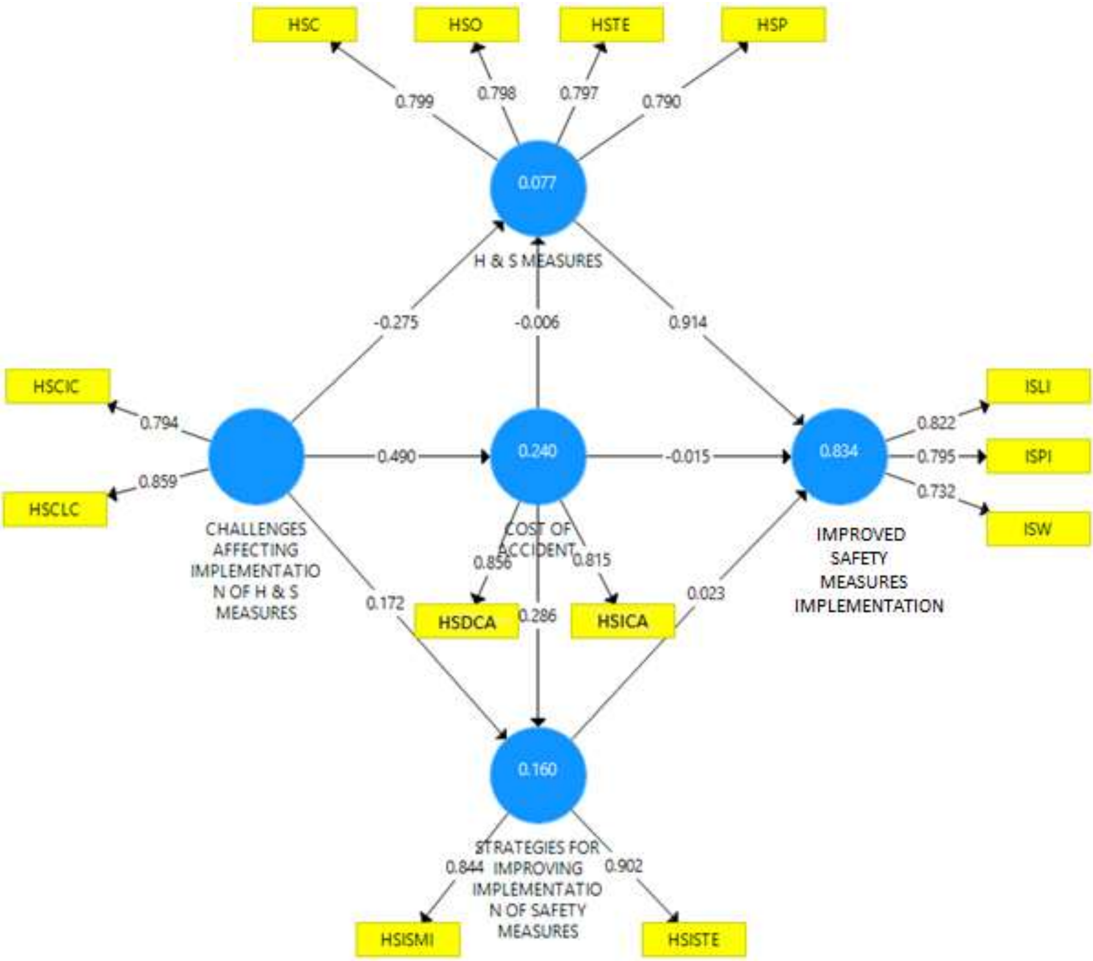

Figure 4.6: Structural Model with Path Coefficients and R^2
Source: Author (2021)

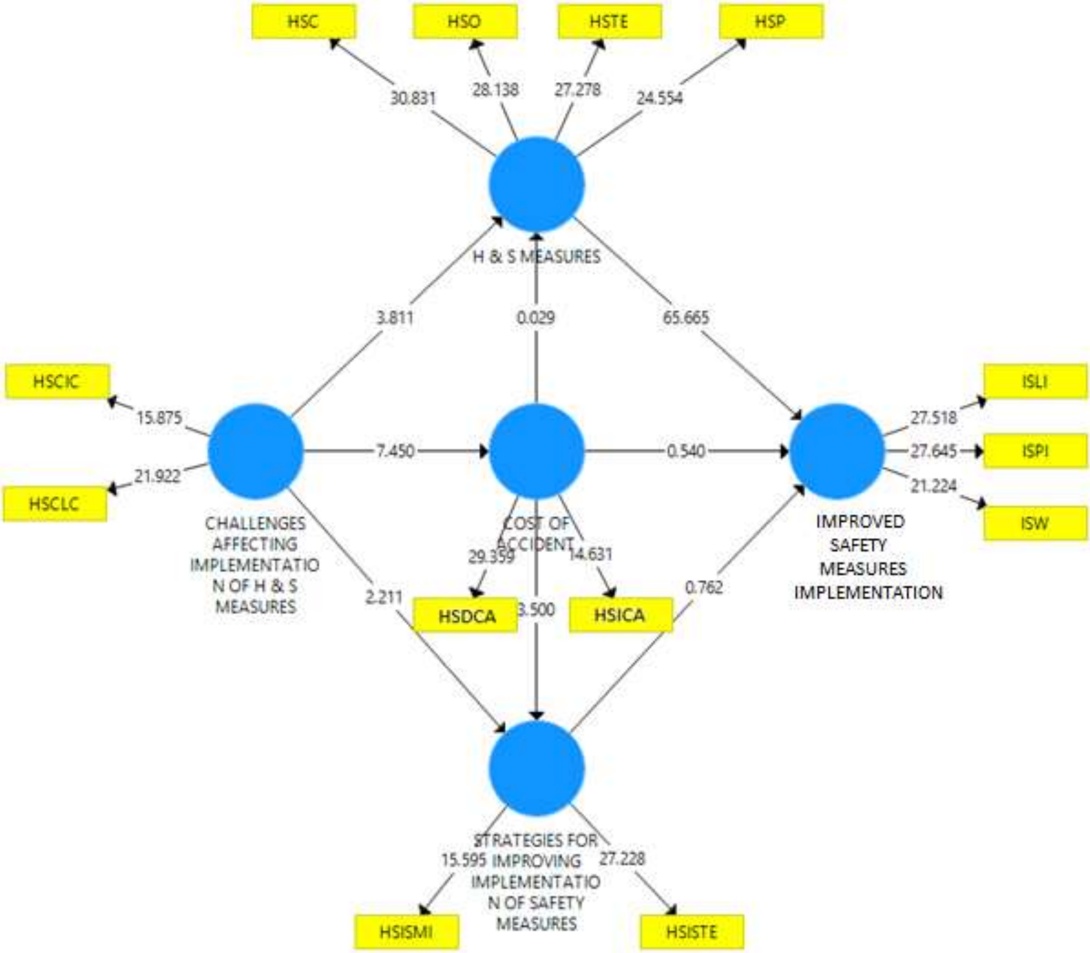

Figure 4.7: Structural Model with t-values
Source: Author analysis (2021)

4.13.5 Effect size (f^2)

The fourth step is assessing the effect size (f^2) of the predictor constructs on the dependent constructs. The effect size is the assessment of the degree of an effect that is independent of sample size. Hair *et al*., (2017) suggest values of 0.02, 0.15 and 0.35 representing a small, medium and large effect respectively (see Table 4.42). However, the values on table 5.42 indicates that the level of H&S Measure's implementation to the improved safety measures had a large effect size in the model with f^2 value of 4.889. Followed by challenges to cost of accident had a medium model effect size with f^2 value of 0.316.Then challenges to strategies, challenges to H&S Measures, and cost of accidents to strategies had a small model effect size with f^2 value of 0.027, 0.062

and0.074 respectively? While cost of accident to H&S measures, strategies to safety measures implementation and cost of accident to safety measures implementation had f^2 value of 0.000, 0.003 and 0.001 respectively indicates no effect as the value is less than the threshold of 0.020 in accordance with Cohen (1988) suggestion. This infers that the level of implementation of safety measures on Construction SMEs and the improved safety measures are two major latent variables that had effect on the model.

Table 4.42: Effect Size (f^2)

Path	f^2	Decision
Challenges affecting implementation of H&S measures →Strategies for improving implementation of safety measures	0.027	Small
Challenges affecting implementation of H&S measures →Cost of accident	0.316	Medium
Challenges affecting implementation of H&S Measures →H&S measures	0.062	Small
Cost of accident →Strategies for improving implementation of safety measures	0.074	Small
Cost of accident → H&S measures	0.000	-
Strategies for improving implementation of safety measures → Improved safety measures implementation	0.003	-
Cost of accident →Improved safety measures implementation	0.001	-
H&S Measures →Improved safety measures implementation	4.889	Large

4.13.6 Predictive relevance (Q^2)

Predictive Relevance (Q^2) is carried out to determine the predictive capability with a blindfolding procedure. If the value obtained is 0.02, 0.15 and 0.35 are categorised as small, medium and large respectively. Table 4.43 indicates the Q^2values for the structural model in this study, it was found that cost of accident had Q^2value 0.163 included in the medium value category, strategies for improving implementation of safety measures had Q^2value 0.111and H& S measures had Q^2value 0.047 included in the small value category respectively while safety measures implementation had Q^2value of 0.504 included in the large value category. This implies that 0.504 (q^2) indicates that improved safety measures implementation has a large effect in the predictive value forthe level of level of implementation of safety measures on construction SMEs. Therefore, the model can be said to be good or the model has a good predictive value.

Table 4.43: Predictive Relevance (Q^2)

	SSO	SSE	Q^2(=1SSE/SSO)
Cost of accident	600	502.291	0.163
H & S measures	1200	1144.03	0.047
Improved safety measures implementation	900	446.83	0.504
Strategies for improving implementation of safety measures	600	533.584	0.111

4.13.7 Application of the PLS SEM model

Structural model validation in PLS-SEM involved a five (5) steps procedure (assessing the structural model for Collinearity issue, assessing the relevance and significance of structural relationships expressed in the model, assessing coefficient of determination (R^2), assessing the effects size (f^2) and assessing the predictive relevance (Q^2).

The step by step procedure governing the application of the model was earlier discussed under chapter 4.13

The PLS-SEM has been confirmed as a reliable and useful tool in prediction of indicators within the construction industry (Xiong *et al*., 2015). PLS-SEM was used in this study as a result of availability of many factors capable of influencing the project success of several construction organizations. It is applicable in Construction SMEs by helping them to make decision on accident prevention and contractual arrangement to adopt which will predict the project success of their construction organizations. With this, labourers and site workers can be managed, less conflicts on building projects, construction process monitored and project failure reduced to the minimum. PLS-SEM can accommodate a large number of predictors in predicting factors that is likely to affect building project success (Hair *et al*., 2014). Construction SMEs can use cross-validation for the selection of their project success variables, and its application to the research hypothesis tested in Chapter Four and Five of this study.

The safety model could be applied on future projects thus;

The research used the rating of the respondents (safety officers) for their agreement on how much each of the constructs provided for in the Model meets Accidents on site minimisation requirements

4.13.8 Benefit of the model

The developed model gives significant benefit to the stakeholders in the construction industry as regards to safety measures implementation in construction SMEs. The study has also established that effective safety measures required for construction SMEs will improve the safety performance. The model developed and validated using PLS SEM t will be very useful in determining means of achieving effective implementation of safety measures for Construction SMEs.

This study has placed emphasis on the urgent need for government to be committed to Health, safety and welfare issues affecting construction SMEs. This is particularly important considering the government's medium term development agenda is to move the country to a middle income status.

Testing and adoption of the developed safety measures implementation model for future projects will gives a strategic guide on safety measures processes for successful project delivery.

4.13.9 Limitations of the model

The research was limited to the following;

i. The safety measures implementation model was limited to cost and productivity

ii. Construction projects were limited to building projects excluding civil engineering works.

iii. The study was limited to Construction SMEs within Abuja, Nigeria

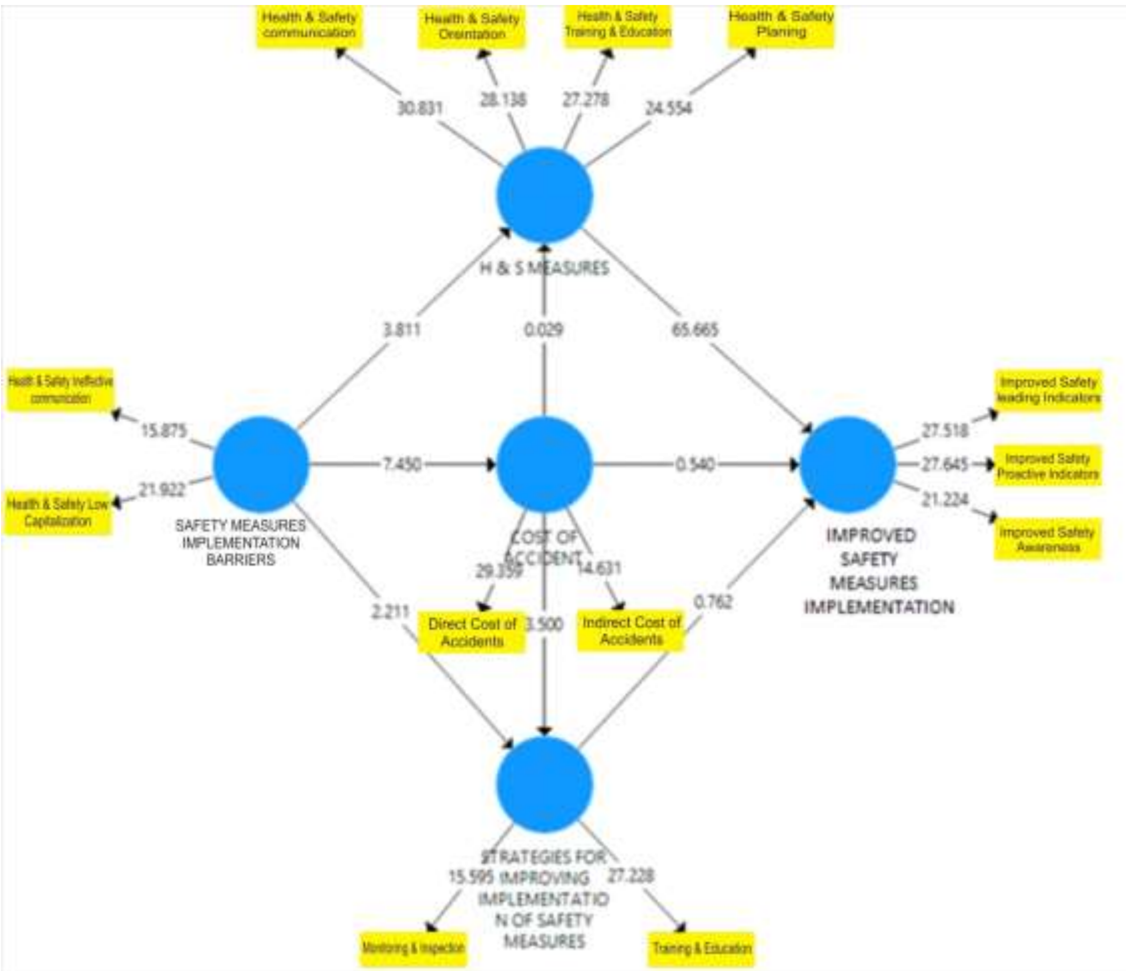

Figure 4.8: Safety Measures Implementation Model
Source: Author analysis (2021)

The list of constructs and indicator variables was obtained as a result of item reduction analysis carried out to make sure that only prudent, functional, and internally consistent items are ultimately included for further analysis. Therefore items that are not or are the least related to the constructs are being eliminated. Firstly, Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity was conducted on five (5) constructs (Barriers, Cost of accidents, H&S Measures, Strategies and Improved safety measures implementation) to guarantee sampling adequacy and the significant level required to perform further analysis (Field, 2013). The KMO was assessed using the approach recommended by Tabachnick and Fidell (2014); Hair *et al* (2010); Pallant (2011) that the KMO value ranged between 0 and 1, with minimum value of 0.5, to indicate the sample is adequate and Bartlett's test of sphericity is significant at ($p<0.005$). KMO values of all the five (5) constructs are above the minimum value of 0.5., while the Bartlett's test of sphericity are all significant at ($p=0.000$). Hence, the two tests indicate that the sampling are adequate and can be considered for further analysis. Figure 4.5 shows the Initial theoretical Model with all indicators

4.13.10 Goodness of fit of the model

Fit indices are important indicators of model performances, reporting of fit indices in any SEM is highly recommended and needed. Approximately 93.8% of SEM publications provided model fit indices. However, the remaining 6.2% that did not report model fit indices did so without providing any explanation (Fan *et al*., 2016).To present the goodness of fit for the model, Standardized Root Mean Square Residual (SRMR) was used. This measure seeks to normalize the difference between the observed correlation and the predicted correlation. That is, the SRMR quantifies how much the empirical correlation matrix differs from the implicit correlation matrix, and therefore the lower the SRMR the better the goodness of fit (Henseler *et al*., 2009). A value of zero means perfect fit, while a value <0.08 is considered good fit (Cepeda et *al.,* 2018). However, some authors accept values ≤0.10 (Henseler *et al*., 2014).

Similarly, dULS (unweight least squares discrepancy) and dG (geodesic discrepancy) measurements were obtained respectively, which are also adjustment measurements, but unlike SRMR, the difference is not expressed in the form of residues but in terms of distributions (Henseler *al*., 2009). The model had an SRMR value of 0.10. Since the value is not above the threshold of 0.10it is considered accepted and that the model has a good fit.

4.14 Discussion of Findings from the Model Result

PLS-SEM was used to test both the direct and indirect relationships among all the constructs. The predictive power was analysed using R^2 as shown in figure 4.6. A moderately strong predictive value was gotten for cost of accident 0.282 (28.2%) and safety performance 0.834 (83.4%). In addition, they all complied with Falk and Miller

(1992) rule by being above 0.1. However, improved safety measures construct was considered the strongest, explaining 83.3% of the variance. Also, the structural model path coefficients determined from the t-value, and significance level (p-value) for all hypothesized relationships in the model indicates that maximum six (6) of the paths (H1, H2, H3, H4, H8 and H9) were strongly significant and only three (3)paths (H5, H6 and H7) did not meet the required value of the rule of thumb.

Considering the effect size of the model, the result of the analysis shows that H&S Measures toImproved safety measures implementation (H8) had a large effect size with f^2 value of 4.889. Challenges affecting implementation of safety measures to cost of accident (H2) had f^2 value of 0.316 was said to be have medium effect on the model, while challenges affecting implementation of safety measures to strategies for improving implementation of safety measures (H1) had f^2 value of 0.027, challenges affecting implementation of safety measures to H&S Measures (H3) had a f^2 value of 0.062 and cost of accidents to strategies (H4) had a f^2 of 0.074 which were said to be having small effect on the model. In addition cost of accident to H&S measures(H5) had f^2 value of 0.000, strategies to safety measures implementation (H6) had f2 value of 0.003 and cost of accident to improved safety measures implementation(H7) had a f^2 value of 0.001 were indicated to have no effect on the model.

Looking at the predictive relevance of the constructs in the model it was indicated that, strategies for improving implementation of safety measures and H & S measures had Q^2value 0.111 and 0.047 respectively had a small predictive relevance. Cost of accident with Q2value was found to have medium predictive relevance on the model, while improved safety measures with Q^2value of 0.504 had a large predictive relevance in the model fitness, This deduces that the level of implementation of safety measures on Construction SMEs and the improved safety measures had major effect on the model.

This also implies that safety measures implementation in construction SMEs had an R^2 of 0.834 this means 83.4% of the measures implementation were influenced by the strategies or improving the safety measures implementation such as use of first aid kits and use of personal protective equipment .Therefore, the model can be said to have a good predictive value. The SRMR value of 0.10 was obtained and this was considered accepted meaning that the model has a good fitness.

4.15 Summary of Findings

The objectives and related findings are being discussed in this section as thus:

4.15.1 Objective 1

To determine the effective safety measures required on construction SMEs.

Results from the questionnaire revealed that 26 effective safety measures required on construction SMEs were identified. Five averagely effective safety practices among the practices listed on construction sites according to overall mean were ranked high with: use of first aid kits as the highest ranked safety measures. Which is in line with the study of Jannadi and Bu-Khamsin (2002) that researched on the key elements of safety performance in projects and identified the most significant factors to be use of first aid kits. Alcohol and substance abuse programme is the least on the ranking as the fairly implemented safety measures required on Construction SMEs.

4.15.2 Objective 2

To examine the factors influencing the implementation of safety measures on construction sites by small and medium sized construction firms in Abuja, Nigeria

In order to determine the barriers influencing the implementation of safety measures by construction SMEs, twenty-three (23) challenges were identified from the literature review and ranked with the aid of mean item score (MIS), Low level of compliance with occupational health and safety regulations is the most severe challenges affecting the Implementation of Safety Measures by Construction SMEs in Nigeria. Followed by Weak national OHS standards. Other challenges of safety measures implementation on construction SMEs ranges between poor budgetary provision and implementation and "beliefs" which is the least ranked, this corroborate with the study of Smallwood and Haupt (2002) that construction industries are not concerned with the safety of their employees as their watchword; instead, it suggests the absence of management commitment to occupational health and safety (OHS) in the Nigerian construction industry. Nzuve and Lawrence (2012) which also revealed that low level of inspection and examination of workplaces might determine the level of compliance with OHS regulations as evident in workplaces.

4.15.3 Objective3

***To determine the effect of implementation of safety measures on the cost of accidents*.**

Nineteen (19) effect of implementation of safety measures on the cost of accident were identified through literature review and had been analysed using Mean Item Score (MIS)

Analysis revealed that the most significant effect on the cost of accidents were "cost of workmen's compensation'' followed by De-motivation of workers/reduce morale and

Payment of settlement of injury death claims. The least ranked effect on the cost of accident is the legal fees for defense against claims/litigation.

4.15.4Objective 4

To examine the strategies for improving the level of implementation of safety measures for small and medium sized construction firms in Abuja.

In achieving this objective, Communication of H&S policy and programs to staff, Provision of personal protective equipment, Deal with any hazards promptly and Collective protective equipment such as scaffolding, safety nets fencing and accessibility, toolbox safety talks were the most effective strategies for improving the level of implementation of safety measures for construction SMEs in Abuja while Meet fire safety standard, Reward and Penalty system and learning organisation were the least important items.

4.15.5 Objective 5

To develop a model for implementation of safety measures for small and medium sized construction firms in Abuja, Nigeria.

Numerous studies have developed models for implementation of safety measures for SMEs of different countries. This study set out to develop a model for implementation of safety measures for small and medium sized construction firms in Nigeria. To achieve this, a model was developed from literature in which the constructs were tested for statistical significance relationships. Six out of the nine relationships tested had statistical significance while three did not have statistical significance. For this model, in determining its fitness, the model had an SRMR value of 0.10. Since the value is not above the threshold of 0.10. From all above it could be said that the model is capable of predicting effective implementation of safety measures for small and medium sized construction firms in Nigeria.

4.16Summary of Chapter Four

PLS-SEM technique was employed for this study to test and validate the conceptual framework hypothesized and developed in Chapter two, and to test if there are statistically significant relationships that exist between the research constructs in the model. The result of the links in the structural model tested most of the constructs to have an impact on construction SMEs safety performance. The model tested had an overall prediction power of 83.4% with a medium effect size f^2 of 31.6 on the latent variables tested. The effect size f^2 values and the T-values for the model fit and validation as shown in Table 4.42 and Table 4.43 showed that the model could predict improved safety measures implementation and is suitable for global validation of a path model in any given construction SMEs. Improved safety measures implementation will help reduce the rate of accidents in construction SMEs and improve construction safety performance

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Upon conducting an extensive review and analysis, the study arrives at the following conclusions: that the use of first aid kits, use of personal protective equipment (PPE), safety policy, safety personnel, health and safety risk assessment, health and safety training, good working environment, welfare facilities, and safety inductions are the effective safety measures required on Construction SMEs. Safety implementation model was developed to prevent accidents in the construction SMEs, this model incorporated several constructs that will enhance the reduction or prevention of accidents in construction projects

.The findings also reveals that the factors influencing the implementation of safety measures by Construction SMEs are low level of compliance with OHS regulations, weak national occupational H&S standards, poor policy implementation and poor budgetary provision and implementation.

On the effect of implementation of safety measures on the cost of accidents, it was revealed that; cost of workmen's compensation, de-motivation of workers morale, payment of settlement of injury/death claims and operational inefficiency are the effect of implementation of safety measures on cost of accidents. Communication of H&S policy and programs to staff, use of collective protective equipment such as scaffolding, safety nets fencing and accessibility, toolbox safety talks and use of building code of practice are the effective strategies used for improving the level of implementation of safety measures on Construction SMEs.

The conceptual model was validated through findings derived from PLS-SEM conducted using Smart PLS 3.3.2. The analysis of the SEM revealed that there was no positive statistically significant relationship between Cost of accident and H&S measures, Strategies for improving implementation of safety measures and Improved safety measures implementation, Cost of accident and Improved safety measures implementation.

The SEM analysis also revealed that positive statistical significant relationship exists among the constructs of the eight (8) hypothesis out of nine(9), while an indirect relationship exist between factors influencing the implementation of H&S measures and Improved safety measures implementation was also significant.

As a result of these, the study concluded that the constructs that constitute the strategies for improving the implementation of health and safety measures are: training and enforcement, awareness and advocacy, safety programs and monitoring and inspection, and all these constructs showed positive significant effects on improved safety performance. The research therefore concluded that the construction SMEs in Nigeria can adopt the developed model to ensure effective implementation of safety measures for promoting safety performance in construction firms.

5.2 Recommendations

To ensure effective implementation of safety measures for construction SMEs, the following recommendations are drawn from the conclusions of the study:

i. Organisations and construction stakeholders should encourage, ensure, and promote the proper implementation and adoption of the developed and validated model for safety measure implementation as it is intended to support small and medium size construction firms as well as professionals in identifying safety issues, putting measures in place to curb challenges inhibiting safety measures implementation and improving on the safety practices of SMEs in order to enhance firm's competitive advantage and boost performance.

ii. Construction firms should encourage and enhance the implementation/use of first aid kits, personal protective equipment (PPE) and safety policy as they have been identified as the effective safety measures required on construction sites to further reduce accidents and unnecessary expenses that may amount as result of accident.

iii. Since it has been identified that; low level of compliance with OHS regulations, management commitment, lack of adequate information on occupational health and safety (OHS), weak national occupational health and safety (OHS) standards, and weak legal structures are the major challenges affecting the implementation of safety measures by construction SMEs. This study recommends that firms should have a more stringent in-house rules by incorporating the 'carrot and stick' approach (that is, a combination of reward and punishment) to induce good behaviour. In addition, reduction in cost of safety training, adoption of seminars and workshops to engage SMEs to be part of OHS activities, and ensuring the right safety culture for professionals/site workers is crucial for the advancement of OHS and for the wellbeing of the workers.

iv. Disruption of site activities, personal injury claims, cost of workmen's compensation, time lost due to absence from work, loss of confidence and reputation, reduction in productivity, and strained management-labour relationship have been identified to be the effect of implementation of safety measures on the cost of accidents, therefore, this study recommends that, though construction professionals think profit will decrease and safety cost will increase when safety measures are implemented on construction projects. However, investment in safety measures will increase profitability by increasing productivity and uplifting employee confidence.

v. This research recommend that construction firms should ensure provision of adequate personal protective equipment, communication of H&S policy and programs to staff, encourage the use of building codes of practice, provide collective protective equipment such as scaffolding, safety nets fencing and accessibility, provide first aid supplies, deal with any hazards promptly, training and enforcement risk awareness, management and tolerance, and conduct safety inspections at predetermined intervals so as to improve the level of implementation of safety measure on construction sites by SMEs.

5.3 Contribution to Knowledge

The findings from this research will help construction SMEs in the following aspects:

i. Safety measures implementation model was developed for improving safety performance of SMEs for better productivity.

ii. The use of first aid kits, use of PPE, safety policy, safety personnel, H&S risk assessment, H&Straining, good working environment, welfare facilities, safety inductions were identified as drivers for promoting effective safety measures in construction sites.

Iii Five (5) major factors were identified as barriers to safety measures implementation in construction SMEs these factors include ;: low level of compliance with OHS regulations, weak national OHS standards, poor policy implementation, poor budgetary provisions and low priority given to safety of construction workers by contractors. .

iv It has also determined that: disruption of site activities , personal injury claims, cost of workman's compensation,, loss, of confidence and good reputation, reduction in productivity and strained management labour have direct influence on the cost of accident in construction firms in Nigeria.

5.4 Areas for Further Studies

This research has mainly focused on SMEs construction projects within Abuja, Nigeria. Consequently, there is a need for research into the application of the concept in other parts of the country, in order to increase the generalisability of the findings. Further constructive data collection method (qualitative) such as interview method with the SMEs respondent could also further assist in highlighting more significant results.

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APPENDIX A

QUESTIONNAIRE FOR PILOT SURVEY

Department of Quantity Surveying
Federal University of Technology
Minna, Niger State

QUESTIONNAIRE SURVEY

DEVELOPMENT OF MODEL FOR THE IMPLEMENTATION OF SAFETY MEASURES FOR SMALL AND MEDIUM-SIZED CONSTRUCTION FIRMS IN ABUJA NIGERIA

SECTION A: General Information of Respondents

Please provide your name, position and the details of your organization.

All responses will be treated with strict confidentiality and will not in any way be connected to you or your organisation.

Name (Optional): ____

Position: ____

Organization: ____

Years of Experience: ____

Telephone: ____

Postal Address: ____

Email: ____

SECTION B: Firms Organisational Features

Q1: When was your company established? *(Please write in the box)*

Q2: How many employees were there in your company from 2015 till date? *(Please tick in the boxes provided below).*

NUMBER OF EMPLOYEES	2015	2016	2017	2018	2019	2020
Not more than 30 employees						
31 - 70 employees						
71 - 200 employees						
Greater than 200 employees						

Q3. What type of construction work does your company undertake? *(Please enter approximate percentage % in the box below).*

TYPE OF CONSTRUCTION WORK		APPOXIMATE PERCENTAGE
Building Construction		
Civil Engineering		
Others (Please Specify)		

Q4: What was your company's approximate turnover for the past five years? *(Please tick)*

TURNOVER	2015	2016	2017	2018	2019
Less than =N=2,000,000.00					
Between =N=2,000,000.00 and =N=5,000,000.00					
Greater than =N=5,000,000.00 but not exceeding =N=10,000,000.00					
Greater than =N=10,000,000.00 but not exceeding =N=15,000,000.00					
Greater than =N=15,000,000.00 but not exceeding =N=20,000,000.00					
Greater than =N=20,000,000.00					

Q5 Please tick from the options below the nature of your firm's origin based on the Public Procurement Act 2007 Classification.

ORIGIN OF FIRM	Wholly Indigenous	Partly Indigenous	Foreign
RESPONSE (√)			

Q6: What is the geographical spread of your firm in terms of scope of operation? *(Please tick)*

SCOPE OF OPERATION	MULTINATIONAL	NIGERIAN		
		National	Regional	Local
RESPONSE (√)				

SECTION C: Firms' Health & Safety Management Practices

Q7: Does your company have a health and safety policy? *(Please tick)*

YES	NO

*** If you answered yes to question 7 (Q7), please it would be greatly appreciated if a copy could be returned with the completed questionnaire.**

Q8: Does your company have specific budget for health and safety? *(Please tick)*

YES	NO

Q9. If you answered yes to question 8 (Q8), please state the budget amount for a five-year period. *(Please write in the box below)*

YEAR	2015	2016	2017	2018	2019
HSE BUDGET AMOUNT (=N=)					

Q10: How many accidents have occurred annually in your firm from 2015 - 2019? *(Please write in the boxes below)*

SEVERITY OF INJURY	FIGURE				
	2015	2016	2017	2018	2019
Minor injuries requiring less than one day off work					
Injuries requiring one to three days off work					
Four or more days off work including strains, sprains, lacerations etc. resulting in four or more days off work					
Fatal injuries causing permanent disability or death of employee					

Q11: The study has identified the following regulations capable of enhancing the effectiveness of H&S measures on small and medium sized construction firms in Nigeria. Please indicate by ticking in the blank spaces provided in the table below, the level of importance of these regulations on a five-point scale in your opinion

S/No.	H&S Regulations	5 Most Importan t	4 Very Importan t	3 Importan t	2 Less Importan t	1 Least Importan t
1	H&S Provision in Condition of Contract					
2	H&S Provision in Workmen Compensation Act					
3	H&S Provision in Factories Act 1990					
4	H&S Provision in Public Health Act 1990					
5	National Building Code 2016					
6	H&S Provision in Labour, Safety & Welfare Bill 2012					

Q12: What difficulties do you face in the implementation of safety measures for the construction firm? *(Please use a separate sheet if necessary)*

Q13: What are your suggestions for helping small and medium sized construction firms to implement safety measures more effectively to minimize the incidence of ill health and accidents on construction SMEs ?*(Please use a separate sheet if necessary)*

SECTION D: Level of implementation effective Safety Measures Required On Construction SMEs

Q14. Please (tick) as appropriate to indicate your assessment of the level of implementation of effective safety measures required on the construction SMEs using the following scale: **Completely Implemented**=5, **Averagely Implemented**=4, **Fairly Implemented**=3, **Partially Implemented**=2 and **Not Implemented=**1

S/N	Effective Health and Safety Measures	5 Completely Implemented	4 Averagely Implemented	3 Fairly Implemented	2 Partially Implemented	1 Not Implemented
1	Use of first aid kits					
2	Use of personal protective clothing (PPE)					
3	Safety policy					
4	Safety personnel					
5	Proper site layout planning					
6	Health and Safety warning signs					
7	Health and Safety risk assessment					
8	Health and Safety training					
9	Good working environment					
10	Welfare facilities					
11	Keep safety procedures updated					
12	Display of safety information clearly					
13	Use of posters and other signs to give safety education					
14	Safety inductions					
15	Safety meetings					
16	Alcohol and substance abuse programme					
17	Provision of insurance cover for site and employee					
18	Operation and maintenance manual					
19	Temporary fencing and gate house					

SECTION E: Challenges Affecting the Implementation of Safety Measures by Construction SMEs

Q15. Please (tick) as appropriate to indicate your assessment of the level at which the **following challenges affect the implementation of safety measures in your organisation** based on your experience since you joined your organisation, using the following scale; **Very Severe**=5 **Severe**=4, **Fairly Severe**= 3, **Less Severe**=2 and **Least Severe**=1

S/N	Challenges of Safety Measures Implementation	5 Very Severe	4 Severe	3 Fairly Severe	2 Less Severe	1 Least Severe
1	Low level of compliance with safetymeasures regulations					
2	Weak national OHS standards					
3	Lack of adequate information on OHS					
4	Bribery and corruption					
5	Weak legal structures					
6	Beliefs					
7	Provision of safety facilities					
8	Awareness and proper medium of information dissemination.					
9	Management commitment.					
10	Absence of safety representatives					
11	Lack of funding for inspecting and H &S plan in a construction sites					

SECTION F: Strategies Used for Improving the Level of Implementation of Safety Measures

Q17. Please (tick) as appropriate to indicate your assessment of **the various strategies used for improving the level of implementation of safety measures in your organization** based on your experience since you joined your organisation, **using the following scale; Very Effective=**5**Effective=**4, **Fairly Effective=**3, **Less Effective=**2 **and Least Effective=**1

S/N	Strategies Used for Improving Safety Measures Implementation	5 Very Effective	4 Effective	3 Fairly Effective	2 Less Effective	1 Least Effective
1	Communication of H&S policy and programs to staff					
2	Provision of personal protective equipment					
3	Deal with any hazards promptly					
4	Collective protective equipment such as scaffolding, safety nets fencing and accessibility.					
5	Display safety information clearly					
6	Maintain comfort and cleanliness					
7	Provide first aid supplies					
8	Meet fire safety standard					
9	Use of Building codes of practice					
10	Keep safety procedures updated					
11	Recognition and Reward					
12	Employee engagement					
13	Training and Competence					
14	Learning organization					
15	Risk Awareness, management and tolerance					
16	Training and Enforcement					
17	Safety inspection					
18	Strategic safety communication					

19	Worksite organization					
20	Safety audit					

Thank you very much for your co-operation.

For further enquiries please contact:

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APPENDIX B

COVERING LETTER ON QUESTIONNAIRE SURVEY

Dear Sir/Madam,

Research into the Development of model for implementation of safety measure for small and medium-sized construction firms in Abuja, Nigeria.

I am writing to request you to take part in a PhD research project, which aims to evaluate the development of model for implementation of safety measures for Small and Medium-sized construction firms (construction SMEs) in Abuja, Nigeria with a view to improving safety performance of construction firms. The research is being carried out at the Department of Quantity Surveying, Federal University of Technology Minna, Niger State. Under the supervision of Dr. A. A. Shittu, Dr. Y. D. Mohammed and Dr. J. E. Idiake.

As part of this research, a survey is conducted to achieve the following objectives:

i. To examine the effective safety measures required on construction sites in Nigeria.

ii. To examine the challenges affecting the implementation of safety measures on construction sites by construction SMEs in Abuja.

iii. To determine the effect of implementation of safety measures on the cost of accidents

iv. To examine the strategies for improving the level of implementation of safety measures by construction SMEs.

v. To develop and validate a model for implementing safety measures on construction sites by construction SMEs in Nigeria.

It would be greatly appreciated if you would fill the questionnaire as soon as possible. I want you to also note that your responses will be treated confidentially

Yours faithfully,

JIBRIL, AdamuMuhammad (Project Researcher).

Department of Quantity Surveying
Federal University of Technology, Minna, Niger State

QUESTIONNAIRE SURVEY

DEVELOPMENT OF FRAMEWORK FOR THE IMPLEMENTATION OF SAFETY MEASURES FOR SMALL AND MEDIUM-SIZED CONSTRUCTION FIRMS IN ABUJA NIGERIA

SECTION A: General Information of Respondents

Please provide your name, position and the details of your organization.

All responses will be treated with strict confidentiality and will not in any way be connected to you or your organisation.

Name (Optional): ____

Position: ____

Organization: ____

Years of Experience: ____

Telephone: ____

Email: ____

SECTION B: Firms Organisational Features

Q1: When was your company established? *(Please write in the box)*

Q2: How many employees were there in your company from 2015 till date? *(Please tick in the boxes provided below).*

NUMBER OF EMPLOYEES	2015	2016	2017	2018	2019	2020
Not more than 30 employees						
31 - 70 employees						
71 - 200 employees						
Greater than 200 employees						

Q3. What type of construction work does your company undertake? *(Please enter approximate percentage % in the box below).*

TYPE OF CONSTRUCTION WORK		APPOXIMATE PERCENTAGE
Building Construction		
Civil Engineering		
Others (Please Specify)		

Q4: What was your company's approximate turnover for the past five years? *(Please tick)*

TURNOVER	2015	2016	2017	2018	2019
Less than =N=2,000,000.00					
Between =N=2,000,000.00 and =N=5,000,000.00					
Greater than =N=5,000,000.00 but not exceeding =N=10,000,000.00					
Greater than =N=10,000,000.00 but not exceeding =N=15,000,000.00					
Greater than =N=15,000,000.00 but not exceeding =N=20,000,000.00					
Greater than =N=20,000,000.00					

Q5 Please tick from the options below the nature of your firm's origin based on the Public Procurement Act 2007 Classification.

ORIGIN OF FIRM	Wholly Indigenous	Partly Indigenous	Foreign
RESPONSE (√)			

Q6: What is the geographical spread of your firm in terms of scope of operation? *(Please tick)*

SCOPE OF OPERATION	MULTINATIONAL	NIGERIAN		
		National		Local
RESPONSE (√)				

SECTION C: Firms' Health & Safety Management Practices

Q7: Does your company have a health and safety policy? *(Please tick)*

YES	NO

*** If you answered yes to question 7 (Q7), please it would be greatly appreciated if a copy could be returned with the completed questionnaire.**

Q8: Does your company have specific budget for health and safety? *(Please tick)*

YES	NO

Q9. If you answered yes to question 8 (Q8), please state the budget amount for a five-year period. *(Please write in the box below)*

YEAR	2015	2016	2017	2018	2019
HSE BUDGET AMOUNT (=N=)					

Q10: How many accidents have occurred annually in your firm from 2015 - 2019? *(Please write in the boxes below)*

SEVERITY OF INJURY	FIGURE				
	2015	2016	2017	2018	2019
Minor injuries requiring less than one day off work					
Injuries requiring one to three days off work					
Four or more days off work including strains, sprains, lacerations etc. resulting in four or more days off work					
Fatal injuries causing permanent disability or death of employee					

Q11: The study has identified the following regulations capable of enhancing the effectiveness of H&S measures on small and medium sized construction firms in Nigeria. Please indicate by ticking in the blank spaces provided in the table below, the level of importance of these regulations on a five-point scale in your opinion

S/No.	H&S Regulations	5 Most Important	4 Very Important	3 Important	2 Less Important	1 Not Important
1	H&S Provision in Condition of Contract					
2	H&S Provision in Workmen Compensation Act					
3	H&S Provision in Factories Act 1990					
4	H&S Provision in Public Health Act 1990					
5	National Building Code 2016					
6	H&S Provision in Labour, Safety & Welfare Bill 2012					

Q12: What difficulties do you face in the implementation of safety measures for the construction firm? *(Please use a separate sheet if necessary)*

Q13: What are your suggestions for helping small and medium sized construction firms to implement safety measures more effectively to minimize the incidence of ill health and accidents on construction sites?*(Please use a separate sheet if necessary)*

SECTION D: Level of implementation of effective Safety Measures Required on Construction SMEs

Q14. Please (tick) as appropriate to indicate your assessment of the level of implementation effective safety measures required on the site of your organisation using the following scale: **Completely Implemented**=5 **averagely Implemented**=4, **Fairly Implemented**=3, **Partially Implemented**=2 and **Not Implemented=**1

S/N	**Effective Health and Safety Measures**	**5 Completely Implemented**	**4 Averagely Implemented**	**3 Fairly Implemented**	**2 Partially Implemented**	**1 Not Implemented**
1	Use of first aid kits					
2	Use of personal protective Equipment (PPE)					
3	Safety policy					
4	Safety personnel					
5	Proper site layout andplanning					
6	Health and Safety warning signs					
7	Health and Safety risk assessment					
8	Health and Safety training					
9	Good working environment					
10	Welfare facilities					
11	Display of safety information clearly					
12	Use of posters and other signs to give safety education					
13	Safety inductions					
14	Safety meetings					
15	Alcohol and substance abuse programme					

16	Provision of insurance cover for site and employee					
17	Operation and maintenance manual					
18	Fencing and Accessibility					
19	Effective communication process					
20	Provision of adequate workers shelter					
21	Provision of adequate medical facilities					
22	Jobsite Inspection					
23	Fire protection programme					
24	Provision of cloak and toilet					
25	Rewarding workers who demonstrate exemplary safe behaviour on site					

SECTION E: Challenges Affecting the Implementation of Safety Measures by Construction SMEs

Q15. Please (tick) as appropriate to indicate your assessment of the level at which the **following challenges affect the implementation of safety measures in your organisation** based on your experience since you joined your organisation, using the following scale; **Very Severe**=5 **Severe**=4, **Fairly Severe**= 3, **Less Severe**=2 and **Not Severe**=1

S/N	Challenges of Safety Measures Implementation	5 Very Severe	4 Severe	3 Fairly Severe	2 Less Severe	1 Not Severe
1	Low level of compliance with safety measures regulations					
2	Weak national OHS standards					
3	Lack of adequate information on OHS					
4	Bribery and corruption					
5	Weak legal structures					
6	Beliefs					
7	Provision of safety facilities					
8	Awareness and proper medium of information dissemination.					
9	Management commitment.					
10	Absence of safety representatives					
11	Lack of funding for inspecting and H &S plan in a construction sites					

12	Lack of enabling environment (Social, Political, Legislative, macroeconomic and bureaucratic obstacles etc.).					
13	Low capitalization					
14	Poor budgetary provision and implementation					
15	Poor policy implementation					
16	Lack of organisational structure					
17	Absent or ineffective communication					
18	Shortage and wrong use of protective equipment					
19	Low priority given to safety of construction workers by contractors					
20	Failure to report accident to appropriate authority					
21	Failure to include the safety personnel into the design of the building					
22	Contractor low awareness to health and safety requirements					
23	Underpayment of the safety personnel					

SECTION F: **Effect of Implementation of Safety Measures on the Cost of Accidents**

Q16. Please (tick) as appropriate to indicate your assessment on the effect of implementation of safety measures on the cost of accidents based on your experience since you joined your organisation, using the following scale; very high effect = 5 High effect = 4 , moderately low effect = 3 , low effect= 2 and Least effect= 5

S/N	**Effect of Implementation of safety measures on the cost of accidents**	**5 very high effect**	**4 High effect**	**3 moderately low effect**	**2 low effect**	**1 Least effect**
1	Cost of workmen’s compensation					
2	Payment of settlement of injurydeath claims					
3	Disruption of site activities					
4	Time lost due to absence from work					
5	De-motivation of workers/reduce morale					
6	Medical payments, insurance premium					
7	legal fees for defense against claims/litigation					
8	Training cost for replacement					
9	Strained management-labour relationship					
10	Operational inefficiency/low performance					

11	cost of training and promotion					
12	Loss of confidence and reputation					
13	Expenditure on emergency equipment					
14	Increase in project cost					
15	Reduction in productivity					
16	Loss of opportunity to qualify for future tender					
17	Damages to plant/equipment					
18	Loss of life					
19	Cost of investigating accident					

SECTION G: Strategies Used for Improving the Level of Implementation of Safety Measures

Q17. Please (tick) as appropriate to indicate your assessment of **the various strategies used for improving the level of implementation of safety measures in your organization** based on your experience since you joined your organisation, **using the following scale; Very Effective=**5**Effective=**4, **Fairly Effective=**3, **Less Effective=**2 **and Not Effective=**1

S/N	**Strategies Used for Improving Safety Measures Implementation**	**5 Very Effective**	**4 Effective**	**3 Fairly Effective**	**2 Less Effective**	**1 Not Effective**
1	Communication of H&S policy and programs to staff					
2	Provision of personal protective equipment					
3	Deal with any hazards promptly					
4	Collective protective equipment such as scaffolding, safety nets fencing and accessibility.					
5	Display safety information clearly					
6	Maintain comfort and cleanliness					
7	Provide first aid supplies					
8	Meet fire safety standard					
9	Use of Building codes of practice					
10	Keep safety procedures updated					
11	Recognition and Reward					
12	Employee engagement					
13	Training and Competence					
14	Learning organization					
15	Risk Awareness, management and tolerance					
16	Training and Enforcement					
17	Safety inspection					
18	Strategic safety communication					
19	Worksite organization					
20	Safety audit					
21	Accident Meetings					
22	Toolbox Safety Talks					
23	Reward and Penalty system					

Thank you very much for your co-operation.

For further enquiries please contact:

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APPENDIX C

1. Challenges of H&S Measures and Strategies

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.189[a]	.036	.017	.742

a. Predictors: (Constant), HSISTE, HSISAA, HSISSP, HSISMI

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.169	4	1.042	1.891	.113[b]
	Residual	113.008	205	.551		
	Total	117.177	209			

a. Dependent Variable: HSCC

Coefficients[a]

Mode		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	3.305	.458		7.213	.000			
	HSISAA	.072	.082	.066	.885	.377	.084	.062	.061
	HSISMI	-.017	.085	-.016	-.196	.845	.044	-.014	-.013
	HSISSP	-.192	.104	-.138	-1.848	.066	-.073	-.128	-.127
	HSISTE	.194	.101	.162	1.927	.055	.128	.133	.132

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.301a	.055	-.009	.972335876851087

a. Predictors: (Constant), CAWLS, CAIC, CALC, CAMC

ANOVAa

Model	Sum of Squares	Df	Mean Square	F	Sig.

1	Regression	1.985	4	.496	.525	.018b
	Residual	193.815	205	.945		
	Total	195.799	209			

a. Dependent Variable: HSC

b. Predictors: (Constant), CAWLS, CAIC, CALC, CAMC

Coefficientsa

Model		Unstandardized Coefficients		Standardized Coefficients			Correlations		
		B	Std. Error	Beta	T	Sig.	Zero-order	Partial	Part
1	(Constant)	3.067	.522		5.878	.000			
	CAIC	-.031	.094	-.024	-.331	.041	-.025	-.023	-.023
	CALC	.091	.118	.060	.772	.441	.024	.054	.054
	CAMC	-.149	.120	..099	-1.247	.014	-.065	-.087	-.087
	CAWLS	.070	.097	.003	.718	.024	.030	.050	.050

Dependent Variable: HSC

2. Challenges Affecting Implementationof H&S Measures and the H&S Measures

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.254[a]	.244	.000	.7566

a. Predictors: (Constant), HSP, HSCC, HSO, HSC, HSTE

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2.830	5	.566	.689	.046[b]
	Residual	116.770	204	.572		
	Total	119.600	209			

a. Dependent Variable: CHALLENGES

b. Predictors: (Constant), HSP, HSCC, HSO, HSC, HSTE

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	3.813	.308		12.399	.000			
	HSC	.046	.069	.058	.661	.0309	-.025	.046	.046
	HSCC	-.083	.077	-.082	1.086	0.009	-.117	-.076	-.075
	HSO	.009	.087	.009	0.105	.0016	-.053	.007	.007
	HSTE	-.090	.077	-.108	0.181	0.039	-119	-.082	-.082
	HSP	-.032	.083	-.035	-.383	0.702	.041	-.027	-.026

a. Dependent Variable: CAIC

4. Cost of Accidents and Strategies for Improving the Implementation of Safety Measures

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.201[a]	.040	.025	.803276563376659

a. Predictors: (Constant), HSISTE, HSISAA, HSISSP, HSISMI

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	6.045	4	1.511	2.342	0.03[b]
	Residual	132.277	205	.645		
	Total	138.322	209			

a. Dependent Variable: HSCA

b.Predictors: (Constant), HSISTE, HSISAA, HSISSP, HSISMI

Coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients			Correlations		
Model		B	Std. Error	Beta	T	Sig.	Zero-order	Partial	Part
1	(Constant)	3.507	.496		7.075	.000			
	HSISAA	.167	.088	.141	1.894	.000	.100	.131	.129
	HSISMI	.072	.092	.066	.789	.031	.018	.055	.054
	HSISSP	-.268	.113	-.178	-2.385	.018	-.145	-.164	-.163
	HSISTE	-.083	.109	-.064	-.762	0.447	-.043	-.053	-.052

a. Dependent Variable: HSCA

5. Cost of Accidents and H&S Measures

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.09i[a]	.08	.103	.770304617819405

a. Predictors: (Constant), HSP, HSCC, HSO, HSC, HSTE

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17.275	5	3.455	1.723	1.81[b]
	Residual	121.047	204	.593		
	Total	138.322	209			

a. Dependent Variable: HSDCA

b.Predictors: (Constant), HSP, HSCC, HSO, HSC, HSTE

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	2.263	.313		7.229	.000			
	HSC	.222	.070	.264	3.149	.002	.276	.215	.206
	HSCC	-.038	.078	-.035	-.493	.623	.042	-.034	-.032
	HSO	.005	.089	.005	.054	.957	.139	.004	.004
	HSTE	-.192	.078	-.213	-2.457	.015	.049	-.170	-.161
	HSP	.243	.084	.249	2.872	.005	.255	.197	.188

a. Dependent Variable: HSCA

6. Strategies for Improving Implementation of Safety Measures and Safety Performance

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.009[a]	.11	.599	.5285

a. Predictors: (Constant), ISW, ISP, ISPI, ISLI

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	88.309	4	22.077	2.28	.132[b]
	Residual	57.251	205	.279		
	Total	145.560	209			

a. Dependent Variable: HSP

b.Predictors: (Constant), ISW, ISP, ISPI, ISLI

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	-.492	.246		-1.997	.047			
	ISLI	.035	.067	.028	.518	.605	.457	.036	.023
	ISP	.334	.053	.296	6.354	.078	.491	.406	.278
	ISPI	.548	.058	.497	9.382	.000	.686	.548	.411
	ISW	.200	.042	.232	4.765	.060	.464	.316	.209

a. Dependent Variable: HSP

7. Cost of Accidents and Improved Safety Performance

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.190[a]	.034	.030	.728

a. Predictors: (Constant), HSPACA, HSDCA, HSICA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	5.033	3	1.678	1.87	.173[b]
	Residual	109.207	206	.530		
	Total	114.239	209			

a. Dependent Variable: ISP

b. Predictors: (Constant), HSPACA, HSDCA, HSICA

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	4.562	.397		11.504	.000			
	HSDCA	-.078	.062	-.086	-1.260	.009	-.075	-.087	-.086
	HSICA	-.211	.074	-.210	-2.855	.015	-.169	-.195	-.194
	HSPACA	.130	.092	.104	1.414	.159	.021	.098	.096

a. Dependent Variable: ISP

8. H&S Measures Implementation and Improved Safety Performance

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.914[a]	.836	.062	.7878865994617

a. Predictors: (Constant), ISW, ISP, ISPI, ISLI

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1.985	4	.496	.525	.0018[b]
	Residual	193.815	205	.945		
	Total	195.799	209			

a. Dependent Variable: HSM

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Correlations		
		B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part
1	(Constant)	1.496	.225		6.641	.000			
	HSC	-.107	.051	.740	-2.119	.035	.141	-.147	-.110
	HSCC	.472	.056	.478	8.426	.000	.592	.508	.437
	HSO	.051	.064	.252	.796	.027	.246	.056	.041
	HSTE	-.054	.056	-.166	-.964	.036	.255	-.067	-.050
	HSP	.347	.061	.391	5.707	.000	.491	.371	.296

b. Dependent Variable: ISP

9. challenges of H&S Measures andSafety Performance

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.672[a]	.452	.438	.554

a. Predictors: (Constant), HSP, HSCC, HSO, HSC, HSTE

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	51.612	5	10.322	33.624	.000[b]
	Residual	62.627	204	.307		
	Total	114.239	209			

a.

b. Dependent Variable: SP

a. Predictors: (Constant), HSP, HSCC, HSO, HSC, HSTE