ADEQUACY AND UTILIZATION OF SAFETY FACILITIES IN BUILDING CONSTRUCTION SITES IN FEDERAL CAPITAL TERRITORY ABUJA AND NIGER STATE, NIGERIA

BY

UMAR, Garba
MTech/SSTE/2018/9314

DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION,
FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, NIGERIA

AUGUST, 2023

ADEQUACY AND UTILIZATION OF SAFETY FACILITIES IN BUILDING CONSTRUCTION SITES IN FEDERAL CAPITAL TERRITORY ABUJA AND NIGER STATE, NIGERIA

BY

UMAR, Garba
MTech/SSTE/2018/9314

THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL, FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, NIGERIA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF TECHNOLOGY (MTech) IN BUILDING TECHNOLOGY EDUCATION

AUGUST, 2023

ABSTRACT

The study was designed to determine the Adequacy and utilization of safety facilities in building construction sites in Federal Capital Territory Abuja (FCT) and Niger State, Nigeria. Six research questions and four null hypotheses guided the study. A descriptive survey research design was adopted for the study. The study was conducted in FCT Abuja and Niger State, Nigeria. The sampled population for the study was 225 respondents comprising of 20 Contractors, 88 Builders, and 117 Tradesmen. 196 items researcher designed structured questionnaire, titled building construction site safety facilities, developed from the literature reviewed for the study, was used to collect data from the respondents. The instrument was face validated by three experts. The reliability of the instrument was determined to be 0.88 using Cronbach alpha method. Mean and standard deviation were used to answer the four research questions; while ANOVA was used to test null hypotheses at 0.05 level of significance. The findings on the adequacy of safety facilities produced a grand mean ($\bar{x}$= 2.66) which revealed that safety facilities such as protective clothing and fire extinguishers were adequate. Findings on the utilization of safety facilities had a grand mean of ($\bar{x}$= 2.44) which showed that facilities such as safety basket for cranes and safety helmet were not being adequately utilized in the building construction sites. Findings on the safety practices adopted in building construction sites had a grand mean of ($\bar{x}$= 2.68) which revealed that safety practices such as wearing safety boot while working and proper positioning of scaffolding before work are not being adopted in building construction sites. Findings on the challenges affecting the utilization of safety facilities produced a grand mean of ($\bar{x}$= 3.42) which revealed that improper supervision and lack of safety training hamper the effective utilization of safety facilities in building construction sites. Furthermore, the grand standard deviation for various sections of the research questions were found to be 0.73, 0.71, 0.73 and 0.60, which were all less than 1.96. This means that the respondents were close to one another in their responses. It was therefore recommended among others that contractors, builders and tradesmen required appropriate training/induction regularly on using the safety facilities in building construction site based on their peculiarities. There should be appropriate information concerning the applications, dissemination and diffusion on using personal protective equipment (PPE) at work, such as the use of safety helmet while working above 3m, ammonia detecting device, safety boot and fire extinguishers in order to prevent accident from site. Working environment should always be cleared and kept free from all objects that can cause harm or injury to the workers in building construction sites.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF APPENDICES

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Building is a structure enclosed by walls and roof. Anyanwu (2013), postulated that building is an action of erecting a structure. Building is the process by which walls and roof are erected or constructed. Building construction is the process of assembling structures to areas. Ogundipe (2017), defined building construction as a process that involves the interplay of many actors in the building industries. One of the actors that play a significant role, from inception to completion of building project, is the building contractor. Building construction is any physical activity involving in the erection of the structure which entail laying of blocks, plastering, cladding, roofing, fitting of services installation, to mention but a few in a building construction site.

Building construction site is a piece of land on which housing work are being carried out. Alfred and Pao-chi (2019) viewed building construction site as plot or land on which a dwelling is being built. Building construction sites are places where erection of building is being under taking through different activities. These activities in building construction sites are marking and grading, excavation, fixing footing and column steel, formwork, concreting of footing, column shuttering and concrete, backfill, plinth beam construction, brickwork, Damp Proof Course (DPC) and next life of concrete, slab formwork, steel fixing and concreting, electrical and plumbing works, finishing work (tiles, doors, painting mention but a few) which are activities carried out by different personnel.

Personnel involve in the building construction site includes but not limited to architects, contractors, tradesmen, builders, estate surveyors and valuers, quantity surveyors, town

planners, civil, electrical, mechanical and structural engineers. All the listed personnel have different responsibilities in building construction site. The contractors' responsibilities in building constructions are for hiring and supervising the workers who work on specific task of the construction project. The roles of tradesmen in building constructions are to build structures and frameworks by following specific blueprints. The architect's responsibility in building construction site according to Kolo (2015) is to create designs for new construction projects, and detailed drawing both by using specialist Computer Aided Design (CAD) applications and hand.

The architects design is actualized by the builder. The builder constructs the building by taking charge of the activities on a building construction site by translating design and working drawings into a physical structure (Ogundipe, 2017). The surveyors' role in building construction site in the words of Okoye and Okoye (2013) is to measure land features such as depth and shape, based on referenced points. These surveys are categorized into estate surveyors and valuers, land surveyors and quantity surveyors with different tasks. The responsibility of town planners is to ease economic and environmental problems within their town of employment and the responsibilities of engineers in construction site are to manage planning and design stage of construction projects (Ogundipe, 2017). All these individual personnel must adhere strictly to the safety regulations in the construction sites.

Safety can be seen as a point at which all associated risks or dangers with a particular job are well managed. Safety in building construction sites is an aspect of construction-related activities concerned with protecting construction workers and others from death, injuries, diseases or other related risks. Building Construction safety according to Kolo (2015) focuses attention on the measures geared towards mitigating occurrence of hazards at the work place. Construction site safety could therefore be seen as the

measures aimed at mitigating hazards at construction sites. Okoye and Okoye (2013) revealed that safety of building construction workers on building sites is paramount to achieving success in any project. The importance of safety in any kind of construction activity is unparalleled. Only when these workers are in a sound state of mind and are physically healthy that work can go on smoothly, as virtually all works on site are dependent on the workers for implementation. Occurrence of accidents or injury to workers tends to demoralize the workers and in some cases leads to suspension of construction activities (Kolo, 2015). Adeagbo *et al.* (2019) argued that in order to safe guard workers in the building construction sites from accident, all personnel should be advice to make effective use of safety facilities in the building construction site. However, these may further depend on the adequacy of these facilities.

Facility adequacy is a state of being sufficient in meeting the requirement of safety facilities for use during erection of building at the construction site with workers. Ogundipe (2017) identified various safety facilities required at any building construction sites to include: safety helmet, safety glasses or face shield, respirator, body protective wears, gloves and safety foot wears, good working environment that's healthy and safe to everyone in the workplace, including those with disabilities. Hence, provision of these facilities at the building construction site may reduce risks of accidents and contractors must also ensure that these facilities are properly utilized.

Utilization is the action of using safety facilities/equipment in an effective way. Olelewe and Amaka (2011) viewed utilization as the process of using safety facilities provided in building construction site. The facilities provided for building construction sites should function properly for personnel to utilize. Hence proper function of all these safety facilities may reduce tendency of accident in the building construction sites. It is also

advisable that these safety facilities are properly utilized and proper safety practices should be strictly adhered to.

Safety practices are generally methods outlining how to perform task with minimum risk to individual, equipments, environment, material and processes. According to Okolie and Okoye (2012) Safety processes are series of specific steps that guide worker through a task form start to finish in a chronological order. The safety processes are steps to be taken in a building construction site to reduce accident, injuries or deaths. Safety practices in construction sites is needed to be highly considered in order to reduce the risk of being injured at work. Safety is also identified as one of the major factors affecting the image of the project manager and the organization (Zhang *et al.*, 2020). "Safety, health and welfare on construction sites", the training manual published by the International Labour Office (2012) states that high rate of accidents occurs in the construction industry than in the other manufacturing sector. This is possibly because the construction industry consists of high self-employed workers, and large number of seasonal and migrant workers; many of them are unfamiliar with construction processes. In addition, those workers are exposed to bad weather and involved in many different trades and occupations.

However, the manual published by International Labour Office (2012) stated that, "The concerned work should be safe and conditions on the construction site should not cause damage to life, health and professional skills". International Labour Office further explains that employer needs to have safety norms and health standards; there should be safety' practices in construction sites to be followed by the employer. Effective safety management is to make the environment safe, to make the job safe and to make workers safety conscious. Some of the safety measures in building construction sites are; wear your PPE at all times, do not start work without an induction, keep a tidy site, do not put

yourself and other at risk, follow safety signs and procedures, never work in unsafe areas, to mention but a few. The foregoing explanations clearly revealed that the importance of adequate provision of safety facilities and their proper utilization in building construction sites can never be over emphasized when accidents occurs in a site, it may cause human tragedies, de-motivate workers, disrupt site activities and affect overall project cost, productivity and reputation of the construction company concerned.

The practice of facility management in construction industry in Nigeria, most especially in the Nations' capital Abuja is considered to be new; Facility Managers are compelled to be at project fore front in the organizations agenda (John *et al.,* 2014). It is considered to be developing gradually over time as a result of the countries recognition to be one of the rapid and developing economies. However, this idea of facility management practice is disgustingly neglected and the awareness is deeply low and the policy regarding the concept unsatisfactory. There was a study conducted recently on sustainable facility management in Nigeria by Adewunmi *et al.* (2012). The result of the study is that efforts should be devoted to environmental concerns of customers and employees of building facility management organizations, while the use of energy-efficient equipment should be accorded priority to save costs and reduce agony from frequent power challenges in the country". The study concluded that most building facility managers do not possess conventional policies on facility management practices put in place. However, the building facility managers are better charged with achieving goals to make certain ruling concerning building facilities and its connected services in construction industry and make it profitably viable. That is why, international facility management association in Nigeria is at the fore front to make and tender useful leadership and professional skills to its workforce by way of trainings and workshops.

The safety of building construction workforces on building sites is paramount to achieving success in any project. Importance of safety in any kind of construction activity is unparalleled, as stated by Chuks and Uchenna (2013). Only when these workers are in a sound state of mind and are physically healthy that work can go on smoothly as virtually all works on site are dependent on the workers for implementation. Occurrence of accidents or injury to workers tends to demoralize the workers and in some cases leads to suspension of construction activities. This sector is very vital to all other industries as it provides the environment for their operation (Jimoh, 2012). Shelter is one of mans basic necessity in life, the quest for the provision of adequate housing has led to an increase in the activities of the building construction industry in Nigeria. Little or no attention is paid to the safety of the workers who see to the realization of these buildings, they are mostly illiterate and are ignorant of their rights and privileges.

Construction safety is an issue which affects the global construction industry, concerns usually arise whenever major construction activities are to take place (Jimoh, 2012). The reality on ground is that accidents and injuries continually occur on construction sites, some even leading to loss of lives. Most employers fail to provide safety facilities and conducive working environment, while in some cases the workers use the facilities inappropriately, these practices have implications to the workers themselves, the construction company and even the society at large (Agyekun *et al*., 2018). There has been much improvement in safety issues as regard to the construction industry, it should however be noted that there is room for more improvement especially in developing nations, Nigeria inclusive.

The problems experienced are not restricted to a particular country as they cut across virtually all construction sectors. These problems tend to be more persistent in the poor developing nations than in the more developed richer nations. The construction industry in developing nations have performed far below expectation in the area of safety, Nigeria's situation is worse as even the national building code approved by the national executive council in the year 2006 is not being enforced effectively till date. Safety during construction is usually not given priority in most developing nations like Nigeria as it is regarded to be a burden (Idoro, 2011). Safety records in these developing counties are usually poor (Huang & Hinze, 2006). Okeola (2009) stated that there are no reliable data on construction accidents in Nigeria, this is because most contractors fail to report cases of accidents to the ministerial departments in charge of such occurrences, they don't keep proper records themselves. Building construction workers are constantly being made to work under unsafe conditions which pose danger to their lives. Deaths and permanent disabilities have occurred as a result of these poor standards. This shows that government needs to enforce the available regulations to check work site accidents. Idoro (2011) was of the opinion that accident and injury rates in Nigeria as at the year 2020 were two accidents per 100 workers and five injuries per 100 workers due to poor safety facilities, these rates were really not different between the indigenous companies and multinational companies.

A number of challenges limit the performance of the construction industry in Nigeria, they include: lack of skilled labour, shortage of materials, power cuts (Sanusi, 2008). Despite the introduction of mechanization in construction process, and advancement in technology the reality on most sites is that about 50% of manual labour is still utilized in these processes (Okeola, 2009). This high rate of manual labour implementation perhaps plays a significant role in the high accident rates recorded among workers in the construction industry.

Accident on the construction sites in Nigeria are caused and still cause devastative effects on property and lives of workers (Kolo, (2015). Most of the accidents that occurred could be attributable to lack of adequate provision of safety facilities and non-compliances to safety procedures and poor utilization of the existing safety facilities in the building construction sites. Accidents occur frequently on building construction sites in Nigeria with little or no documentation (Kolo, 2015). While some of these accidents are caused due to poor safety facilities, some are caused as a result of the poor or none safety measures employed by the construction companies and staff on site. It is against this backdrop that the researcher intends to examine the adequacy and utilization of safety facilities in building construction sites in FCT, Abuja and Niger State, Nigeria.

1.2 Statement of the Research Problem

The adequacy and utilization of safety facilities at construction sites play an essential role in workers' health and wellbeing. Adequacy and utilization of safety facilities on construction sites lead to direct impact on increase productivity of workers and profits. Dok Yen *et al.* (2018) explain that construction sites needs to be provided with minimum welfare and safety facilities such as safety helmet, protective clothing, dust catchers for aggregate works, first aid box, suitable toilet and washing facilities, portable drinking water, facilities for storage and rest. These safety facilities, when provided, may enhance worker output as well as improve the health conditions of construction workers by preventing unintentional injuries or deaths and, hence, improving the quality of life's construction site productivity.

However, it has been observed that the provision of safety facilities such as personal protective equipment (PPE) that include safeties boots, safety helmet mention are

grossly inadequate even the few available ones are not being effectively used. Adane *et al.* (2013) in their study, they revealed that construction injuries is rare, and very limited attempts have been made to investigate the prevalence and associated factors in Ethiopia. Construction Design and Management Regulation (CDMR, 2015) neglecting of this safety facilities from both building construction personnel and clients may results to potential life threatening of building constructions workers and also may contributes to lack of productiveness of the construction workers. Most sites do not have average require numbers of safety facilities for the workers and also most cases the limited facilities on site are not in good conditions for workers to utilized for their safety status (Ahmed *et al.,* 2018). Therefore, this study is design to determine the adequacy and utilization of safety facilities in building construction site in FCT Abuja and Niger State.

1.3 Aim and Objectives of the Study

The aim of this study is to determine the adequacy and utilization of safety facilities in building construction sites in FCT, Abuja and Niger State. Specifically, the study will seek to achieve the following objectives:

1. Determine the adequacy of safety facilities in building construction sites in FCT Abuja and Niger State, Nigeria
2. Find out the extent of utilization of safety facilities in building construction sites in FCT Abuja and Niger State, Nigeria
3. Determine the safety practices adopted in building construction sites in FCT Abuja and Niger State, Nigeria
4. Identify the challenges on the effective utilization of safety facilities in FCT Abuja and Niger State, Nigeria.

1.4 Significance of the Study

The findings of the study will be of benefit to the contractors, client, health and safety managers, builders, tradesmen, pedestrian, curriculum planners, building construction technology lecturers and government.

The findings of this study will prompt contractors on the importance of safety facilities and also ways of enlightening workers in order to reduce causes of accident, cost of managing accident may outweigh the cost of safety facilities and worker health which will help the contractor in spending less and avoid delay in job completion. A reduction in accidents will also build confidence between client and contractor paving way for more contracts due to safety procedure put in place. No client will accept a given-out contract at the expense of building facilities as a result of safety negligence by the contractor.

The findings of the study will be of benefit to the client through timely job completion, enabling the client to make use of the facilities on schedule. The work will also be of quality as a result of standard specifications and the due process followed in doing the job.

The findings of the study will benefit Health and Safety Managers (HSM) as more time will be directed on organizing sensitization programs on causes of accidents such as safety education, safety drills rather than investigating accident. The practices, procedures and resources for developing and implementing safety procedure will help the HSM in reviewing and maintaining the occupational safety and health policy.

Builders will benefit from the findings of the study because it will help them in gathering information about the project safety facilities needed on the project site before work begin to avoid involvement and ensuring safety during construction phase.

The finding of the study will be of benefit to the tradesmen, since the safety facilities when provided, will enhance production with less injury/fatality. It will also boast their moral and ease the stress used in carrying out the jobs.

Pedestrian, walking in environment close to the site will be safe since perimeter fence demarcates between sites and the road. This will also help to prevent pedestrian trespassing the site without proper safety.

Curriculum planners can obtain and use available data in reviewing safety procedure and accident prevention method in building construction site. This will help to improve training on rectifying of hazards and internal company procedures in accordance with the safety and health rules and regulations which apply to area of work. It will also serve as literature review to other research works.

The findings of the study will unveil to building technology lecturers, more insight on training on safety practices to empower them to impart knowledge to building technology students that would be useful to them in their places of work or self-employment after graduation.

The government through ministry of works will benefit from the finding of the study; regarding enforcement of the law regarding the safety procedure and accidents prevention methods in the construction site. The government can review the laws and regulations for the use safety facilities in construction site. Also since laws are provided, it will help the government in monitoring and inspection of contractors who fails to provide safety facilities in building construction sites and enforce sanctions.

1.5 Scope of the Study

The study is on adequacy and utilization of safety facilities in building construction sites in FCT, Abuja and Niger State. Specifically, the study covered safety facilities, extent

of utilization of safety facilities, safety practices and challenges encountered in the utilization of safety facilities in building construction. However, the study do not covered non registered building construction industries due to unofficial practices, lack of not having a mailed item recorded in a register to enable its location to be tracked, and also lack of insurance to cover loss.

1.6 Research Questions

The following research questions guided the study.

1. What is the adequacy of safety facilities in building construction sites in FCT, Abuja and Niger State, Nigeria?
2. What is the extent of utilization of safety facilities in building construction sites in FCT, Abuja and Niger State, Nigeria?
3. What are the safety practices adopted in building construction sites in FCT, Abuja and Niger State, Nigeria?
4. What are the challenges on the effective utilization of safety facilities in FCT, Abuja and Niger State, Nigeria?

1.7 Hypotheses

The following null hypotheses were formulated to guide the study and were tested at 0.05 level of significance.

H_{O1} There is no significant difference in the mean responses of contractors, builders and tradesmen as regard to the adequacies of safety facilities in building construction sites in FCT Abuja and Niger State, Nigeria

H_{O2} There is no significant difference in the mean responses of contractors, builders and tradesmen as regard to the extents of utilizing of safety facilities in building construction sites in FCT Abuja and Niger State, Nigeria

H_{O3} There is no significant difference in the mean responses of contractors, builders and tradesmen as regard to the safety practices adopted in building construction sites in FCT Abuja and Niger State, Nigeria

H_{O4} There is no significant difference in the mean responses of contractors, builders and tradesmen as regard to the challenges on effective utilization of safety facilities in building construction sites in FCT Abuja and Niger State, Nigeria

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Theoretical Framework

2.1.1 Heinrich domino theory of construction accident causation

Domino theory of accident conceptualized by Heinrich (1941) state that injuries are caused by accidents. Accidents are caused by unsafe acts and conditions. Unsafe acts and conditions are caused by the fault of persons. This theory comprised of five standing dominos that fall one after the other. An accident can be prevented only by removing one of the dominos chain. This interrupts the sequence and ensures that the accident does not happen. Heinrich's Domino theory was one of the most understandable and the clearest theories defining accident processes (Rad, 2013). According to statistics on accident's reports Heinrich deduced that 88% percent of accidents are due to unsafe act of workers, this means lack of conformance to safety practices; 10 percent due to unsafe conditions and 2 percent of all accidents are associated with act of God such as natural disasters. Based on this analysis, Seyyed and Zahra (2012) described the Heinrich Domino theory of construction accident causation as man and machine relationship, frequency and severity relation, unsafe practices, management role in accident prevention, costs of accidents and the impact of safety on efficiency. (See Figure 2.1)

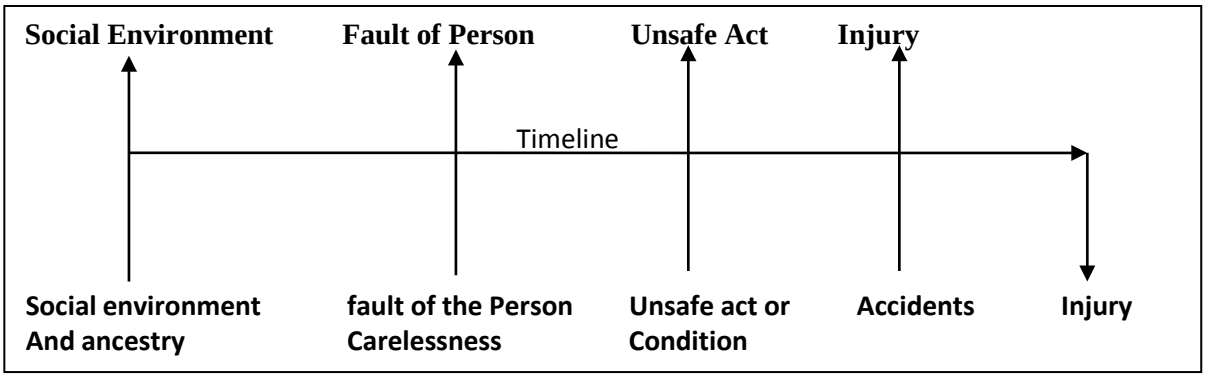

Figure 2.1: Heinrich Domino theory of accident causation developed by Heinrich, (1941).

Heinrich established the 'Domino theory' which is based on five sequential factors as followings:

i. Ancestry and social environment; Ancestry and social environment are the process of acquiring knowledge of customs and skills in the workplace. Lack of skills and knowledge of performing acts, inappropriate social and environmental conditions will lead to fault of person.

ii. Fault of person (carelessness); Faults of person or carelessness are negative features of a person personality although these unwanted characteristics might be acquired. The result of carelessness is unsafe act/conditions.

iii. Unsafe act and/or mechanical or physical condition; Unsafe acts/conditions include the errors and technical failures which cause the accident.

iv. Accident; Accidents are caused by unsafe acts/conditions and subsequently lead to injuries

v. Injury; Injuries are the consequences of the accidents.

Domino's theory comprised of five standing dominos which will fall one after the other if the first domino (Ancestry and social environment) falls (Farhana, 2014). The accident can be prevented only if the chain of sequence is disrupted, for instance the unsafe act/condition can be eliminated in order to prevent the accidents and associated

injuries. Heinrich efforts on construction accident causation theory can be summed up into two points, People (Human) who are the main reasons of construction accidents and Management which has the responsibility of preventing the accidents (having the power and authority).

Heinrich's domino theory was blamed for the process of simplifying the human behavior control in accidents. Heinrich domino theory became the basis for many other studies on construction accident causation model with emphasis on management role in accident prevention; these studies are called Management Model or Domino's Updated Model. Management models believe that management system is responsible for occurrence of accidents.

The relationship between the study and the construction accident causation theory is that both of them are concerned with five standing dominos that will fall one after the other if any domino falls. Ancestry and social environment dominos in the study are the process of acquiring knowledge of safety and skills in the building construction site. Faults of workers or carelessness are negative features of a workers personality although these unwanted characteristics might be acquired. Unsafe acts/conditions can be particularly applied to errors and technical failures which cause the accident. Unsafe acts/conditions could subsequently lead to injuries and accidents consequences which is applicable to this study. This theory therefore has a good link with the study in the area of safety practice and accident control method in the building construction sites.

2.1.2 Accident root causes tracing model (ARCTM)

Accident Root Causes Tracing Model (ARCTM) was propounded by Abdelhamid and Everett (2000). This shows further advances of many of the previous accident models. Many important rules of the model have been derived from the effort of Abdelhamid

and Everett (2000). The main reason of this model is to provide an investigator with an easy model for identification of root causes of construction accidents, compared to sophisticated models of accident's investigation. ARCTM expresses the idea that accidents are caused by one or more of the following factors as stated in the study of Seyyed and Zahra (2012).

i. Not identifying the unsafe condition that existed before or advanced after an activity starts (Unsafe condition)
ii. Performing the task despite the worker realizes the existence of unsafe condition (reaction of worker to unsafe condition)
iii. Performing unsafe act without consideration of task's environmental condition (Unsafe act of worker)

Unsafe condition: Unsafe condition is condition where workplace and its environment are not safe in accordance to safety and health standards. Unsafe conditions include wrong scaffolding, openings, protruding reinforcement bar among others. ARCTM defines two types of unsafe conditions in terms of when they occurred in task sequence and who made the unsafe condition to advance

i. Unsafe condition which exists before commencement of a task
ii. Unsafe condition which progresses after commencement of a task

The ARCTM suggests that the unsafe conditions are the result of one of the following:

i. Management acts or omissions; Management may, for instance, assign workers to do tasks beyond safety standards, not providing workers with protective equipment, not providing safeguards for equipment among others.
ii. Worker or coworker unsafe acts; inexperienced workers or coworkers may perform unsafe acts.

iii. Events not related to human act; Natural disasters such as earthquakes, storms, floods that may lead to unsafe conditions.

iv. Unsafe conditions that initially exist in construction workplaces; Examples of initial unsafe conditions include rough land situation, scattered materials and hidden holes just to mention but few.

Reaction of Worker to Unsafe Condition: Farhana (2014) explained that reaction of workers to unsafe conditions depends on the fact that whether the worker identifies the unsafe condition or not and can be summarized as follows;

i. The construction worker does not identify the unsafe condition; therefore there is no risk and hazard consideration by the worker. There is a fact that some unsafe conditions cannot be identified, such as, not-human-related conditions or human factors violation. Human factors violation may lead to injuries namely cumulative trauma disorders, carpal tunnel syndrome, fatigue, and overexertion.

ii. The construction worker identifies the unsafe condition and recognizes the related hazards; reaction might be safe act and quit the task until the unsafe condition is modified or disregard the unsafe condition and continue the task (unsafe act). The reasons of failure to identify unsafe condition and also the reasons that worker continue the task after identification of unsafe condition should be investigated by management.

Unsafe Act of Worker: A construction worker might perform unsafe acts regardless of the condition of the work (Safe or unsafe condition). In this situations worker might continue the work in unsafe condition or performing the task without safety standards consideration; working without protective equipment or working when one is lacking enough sleep.

According to Rad (2013) application in accident investigation includes the following steps:

i. The first step is to determine the existence of any unsafe condition either before or after commencement of an activity. If the worker was exposed to an unsafe condition, the existence and advancement of unsafe condition should be identified. ARCTM suggests that unsafe condition is caused by four factors they are:

   a. Management acts or omissions: The accident investigator should determine why the unsafe condition was not recognized by management and the personnel in charge of that.

   b. Worker or coworker unsafe acts: The investigator should realize whether the cause of unsafe condition was social, peer or management pressure. Worker attitude problem lead to social and peer problem while management process problem lead to management pressure. Acknowledgement of (co)worker about the correct way of doing the task should be identified by the investigator. The frequency of unsafe act by worker should be determined, if the worker occasionally/always perform unsafely then the problem is related to the management since there should be inspection programs which discourage the unsafe acts of worker (Mosey, 2019). If the worker had committed the unsafe act for the first time then the previous question is to be answered.

   c. The investigator should identify whether the management or worker were able to recognize the unsafe condition or not. If they were capable of identifying the unsafe condition then the problem is related both to worker training and management process, but if identification of unsafe condition was impossible then the accident was inevitable.

ii. The investigator should determine if an unsafe condition existed either before or after the task, and the worker recognized it.

a. If the worker did not recognize the unsafe condition then the investigator should find the reasons of this failure through the questions of ARCTM approach. If the workers assumption on condition was wrong then the reasons should be investigated whether it was due to the incapability to identify the unsafe condition of task because of lack of knowledge, or the task was new to the worker. Worker's training is the basic problem of accident in this situation. If the worker was informed that the condition was safe then the investigator should recognize the informant and the reasons that the informant considered the condition as safe. If a coworker considered the condition as safe and informed the worker then there is a problem related to worker training or attitude, but if the management informed the worker that the condition is safe then the management process is considered to have problem.

Whether the worker followed the appropriate procedure of performing task should be identified by the investigator. If not, then the investigator should find out if the worker knew about the appropriate procedure. If the worker had prior knowledge about the appropriate procedure, the problem is related to the worker attitude, but if the worker did not have the knowledge then the problem is with the worker training. The frequency of performing the task in wrong way by worker should be determined by investigator. If the worker always or occasionally uses the wrong procedure of performing the task then the problem is related to the management since management should inspect and modify the wrong way of performing tasks, but if the worker performs the task wrongfully for the first time then the problem should be traced in the previous question (Seyyed & Zahra, 2012).

b. The reason behind the inappropriate decision made by the worker after having recognized the unsafe condition and continued the task should be determined by the investigator through the questions in ARCTM approach. Whether the worker regarded taking the task was essential or was forced by social, peer or management should be investigated. If management pressure resulted in decision then the problem is related to management process, but if the social or peer pressure resulted in decision to continue the task then the problem is with the attitude of the worker. Whether the worker did not consider all characteristics of the condition should be determined by the investigator; if so then the problem is related to the training of the worker. Whether the worker thought that performing the task could continue safely should be determine by the investigator; if so there is a worker attitude problem. Whether the worker. However, whether the worker knew the appropriate way of doing the task or not should be identified by the investigator; if the answer is positive the problem is related to attitude of the worker. However, the worker did not know the appropriate way, and then the problem is related to worker training. Whether the worker(s) always/occasionally continued the task when they recognized the unsafe condition should be identified by the investigator; if the worker did so then it is a management-related problem because the management should inspect and modify the unsafe act of workers, but if the worker continued to perform the task despite recognizing the unsafe condition for the first time then the problem should be traced in the previous question (Mosey, 2019).

iii. Whether the worker acted unsafely or not if there were no unsafe conditions confronted by worker involved in accident (before or after commencement of task) should be identified by the investigator. The investigator should review the first step for identifying unsafe conditions around the accident when the worker did not

commit any unsafe acts; but if the worker acted unsafely then the investigator should follow the questions to identify the reasons of worker decision. Whether the unsafe act was caused by social, peer or management force should be determined by the investigator; if social or peer act resulted in unsafe act then the problem is related to the worker attitude, but if the management pressure resulted in unsafe act the problem is related to management process. Whether the worker knew the appropriate way of performing the task or not should be identified by the investigator; if the worker knew the problem is attitudinal, but if the worker did not know the correct way of performing the task, the problem is related to the worker training. The frequency of performing task in unsafe manner should be determined by the investigator; if the worker always/occasionally perform the task in unsafe manner the problem is with the management process because the management should inspect and modify worker's unsafe act, but if the worker perform the task unsafely for the first time then the problem should be traced in the previous question (Sarah, 2012).

The relationship between the theory and the study is that both of them are concerned with identification of root causes of building construction accidents and safety procedure put in place. This theory will be applied to the present research by allowing engineers and contractors to monitor the builder to perform task in safe manner. The study seek to improve the knowledge of Workers who are new in the building construction site and do not have enough knowledge and training on performing their tasks for recognizing all unsafe conditions or even preventing accidents from happening. Workers who have enough knowledge and training about how to perform their tasks will not be free of accidents if they do not change their behavior in terms of safety; and finally management process has to be planned as to inspect and eliminate the

unsafe conditions faced by workers proactively; management should continuously mention and reinforce the significance of safety (Farhana, 2014).

2.1.3 The 'swiss cheese' model

The 'Swiss Cheese' accident causation model was first developed by James Reason in the year 2000 as a linear accident causation model. The theory is currently widely used since it simply suggests that the organizations try to prevent accidents by defenses in order not to allow the risks and hazards become loss (See Figure 2.2). These organizational defenses are divided into two groups:

i. Hard defenses which are automatic alarming systems, physical obstacles, engineered safety appliances and weak points included into the main system for protection such as fuses.

ii. Soft defenses which are dependent upon the personnel and procedures; regulations of required performance, investigation, checking, regular procedures of performance, education and training, supervision and working permission. Soft defenses also involve supervisors and operators as the pioneers. Losses to people, equipment, assets are the potential consequences of hazards in an organization. Reason claims that a trade-off exists between the level of protection provided for the product and the production; the risks included in any product should be defended by the organization for the wellbeing of customers but the level of safety and protection should be equivalent to the risks associated with the work. If the level of protection is higher than required then the company will not be commercially profitable and if the protection level is less than the associated risks the occurrence of accident is susceptible and the organization will lose the business opportunities. The equilibrium between the protection and the production is essential for the durable commercial survival of the business;

since the production process is visible the product can be managed and inspected for the desired output but the level of protection can be measured only after the inadequacy is determined (Seyyed & Zahra, 2012).

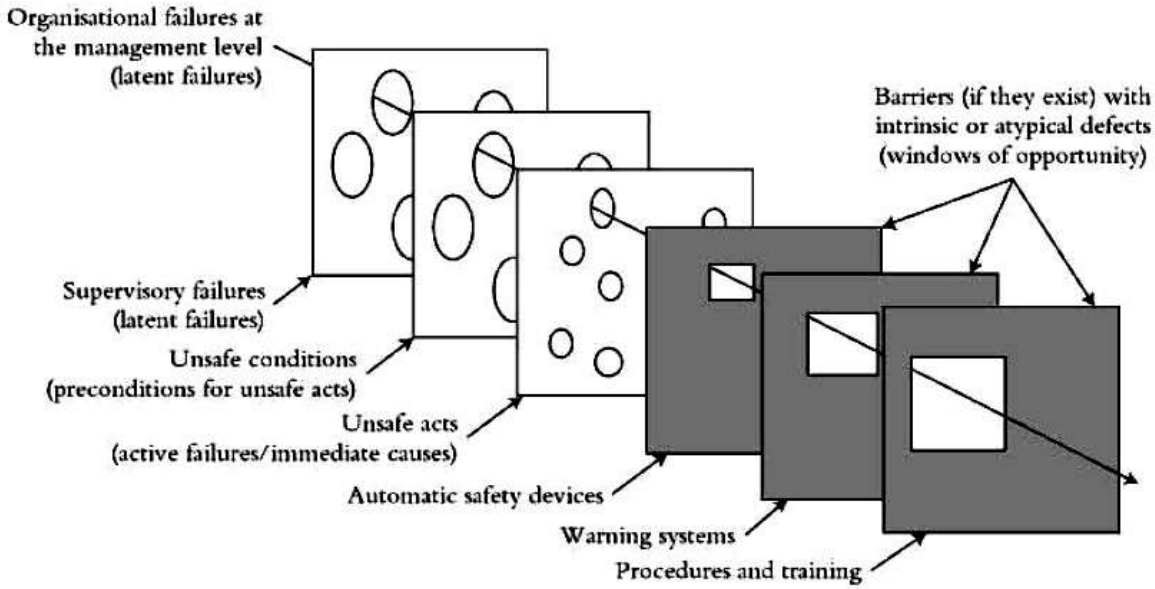

Figure 2.2: Swiss Cheese Accident Causation Model by Reason *et al.*, (2006).

Although organizational accident defenses are seen as obstacles which prevent the hazards from converting into losses, the obstacle and barriers have holes in them as slices of Swiss cheese; Reason called his model Swiss cheese because of theses defects in the organizational defenses. The foremen of an organization are in charge of the sharp-end procedures which represent the "unsafe acts" slice of cheese in the model. The holes in the unsafe act slice are the human errors or un safe acts. Reason believed that accidents are caused by active failures and immediate causes which are the results of mistakes, slips and violations of standards.

Accidents can be either caused by singular human error or a combination of them as immediate causes of accidents; the combination of violation and mistake is a very usual cause of accidents (Farhana, 2014). There have been a lot of improvements in building construction site which means efforts have been made to eliminate the technical failure;

therefore most of the time human errors are blamed to be the major cause of accidents. On the contrast the more improvements are being achieved in technology and engineering, the more number of accidents caused by human errors are reported. Unsafe condition is represented by holes in the next slice of Reason Swiss Cheese Model; the unsafe condition and the psychological risk factors are the contributory factors to unsafe act of workers. Unlike active failures and immediate causes in previous slice, the holes in this slice are the hidden contributory factors of accident (Farhana, 2014).

The theory is related with the current study because it aims at raising very important and interesting point which is in turn aimed at solving problems regarding safety procedure and accident control methods in building construction sites. The relationship between unsafe condition and unsafe act is a one-to-many interaction; unsafe condition can lead to many hazards and unsafe acts. This theory will be adopted for the study because the protection and the production must be at equilibrium. If the level of protection is higher than required then the company will not be commercially profitable and if the protection level is less than the associated risks the occurrence of accident is susceptible and the organization will lose the business opportunities. The theory will be used to equilibrium between the protection and the production as essential for the durable commercial survival of the business, which make the research to adopt this theory.

2.1.4 Social control theory

Social control theory has many applications that go beyond the realm of safety and risk reduction. Social control theory was introduced by Hirschi (2015), which states that connectedness to organizations promotes behavior conformity, which can reduce the probability of high-risk behavior. The research in this area shows that an individual's connection to and alienation with construction site or workplaces has a positive influence on risk perception. In a review of educational connectedness and engagement,

construction site connectedness was an important factor in preventing workers from engaging in risk-taking behaviors, such as working without personal protective equipment, smoking, alcohol and operating machine without safety consideration with impaired drivers (Chapman *et al.,* 2013).

Employee engagement through volunteer or safety programs tends to raise risk awareness and reduce risk taking in the workplace (Farhana, 2014). Being able to participate in hazard identification and contribute to workplace safety improvement builds affiliation with an organization and leads to safer work practices.

Organizational identification, or a connection to organizational goals and a collective work identity, was associated with fewer construction site hazards and greater safety participation. Employees with more organizational identification were more likely to encourage coworkers to follow safe work procedures and take action to stop safety violations (Farhana, 2014). The researcher also found that psychological empowerment and organizational identification were tied to use of protective equipment when supervisors communicated safety as a top priority. Lastly, Seyyed and Zahra (2012) found that safety climate scores were highly correlated with worker compliance with safety rules and the reduced frequency of deliberate exposure to occupational risks.

The relationship between the theory and the study is that both are concerned with safety procedure and methods of accident control. The study seek to improve the overall interest of organizations which is in this case is applicable to building construction site at large scale, employers as well as the employees by putting safety facilities in place in order to encourage the workers on safety compliance and to eliminate the accident in the construction site by providing safety facilities to the workers of building construction company.

2.2. Conceptual Framework

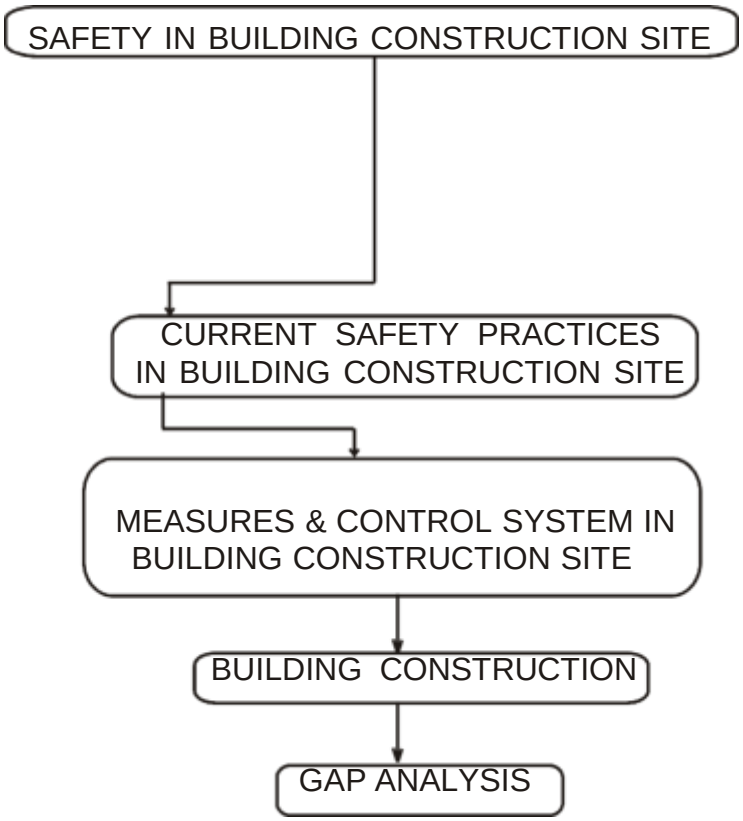

Figure 2.3: Conceptual frame work of safety procedure and accident control method in building construction site.

Author Original Construct

The conceptual framework of the study based on adequacy and utilization of safety facilities in buildings construction site. Building construction site entailed different tasks, during the task accidents occur. Accidents on construction site in Nigeria have caused and still cause divesting effects on property and the lives of workers, as well as affecting the timely delivery of project and within budget. Studies have been carried out that revealed poor safety practices are evident at Nigeria construction sites. This maybe attributable to lack of commitment to safety by stakeholder, lack of government support, little or no diligence while enforcing safety regulation on site and lack of proper safety education programme. The purpose of safety facilities must be well

known to the builders and contractors and also the builders should abide by the safety rule during the operation which will contribute to safety in construction sites.

2.2.1 Building and building construction

Construction as a general term means, the art and science to form object, systems, or organizations which include building construction. According to Anyanwu (2013) building construction is the process of adding structures to areas of land, also known as real property sites. Typically, a project is instigated by or with the owner of the property (who may be an individual or an organization). Anyanwu further explain that, building construction is divided into residential and non-residential. The residential building is any public building which is used for sleeping or lodging purpose and includes any apartment house, rooming house, hotel, children's home; community based residential facility or dormitory but does not include roads, bridges and culverts. Base on this Mosey (2019) opinion that residential construction practices, technologies, and resources must conform to local building authority regulations and codes of practice. Material readily available in the site generally dictates the construction materials used (such as brick, stone or timber). Cost of construction on a per square meter basis for houses can vary dramatically base on the site conditions, local regulations, economies of scale and the availability of the skilled trade-people.

Construction Process and the Key Participants: The building construction process in Nigeria is fragmented and complex, as it is made up of numerous projects of various sizes, managed by a number of different players and stakeholders as indicated in Figure 4 throughout its life cycle. The construction process in Nigeria was inherited from the British system of construction, which involves a number of stages that are distinct or may overlap depending on the nature of the building construction and the procurement methods (Sarah, 2012). Basically, various procurement systems are used which include;

traditional procurement methods, design and build, Project management and Build, Operate and Transfer (BOT). For a typical building project based on the traditional procurement system which is mostly used in the construction process is divided into four main stages namely; briefing, design and procurement, construction and operation and maintenance (Sarah, 2012).

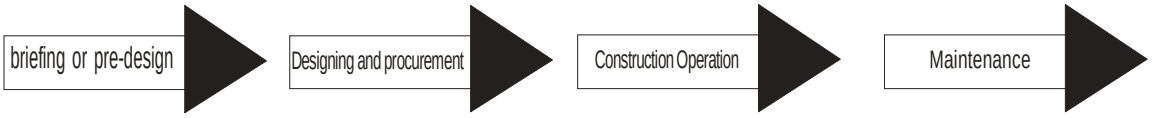

Figure 2.4: Building construction stages by Sarah (2012).

The four construction stages are distinct but depend on each other. The briefing stage is often regarded as the early stage in the construction process during which the client's requirements are written down in a formal document. The brief provides a fixed reference point for the subsequent design of the building by the designers. At the design and procurement stage the architect will produce the architectural design, and the engineers will produce the engineering design according to the client's requirements from the briefing stage. Meanwhile at the same stage the quantity surveyor will prepare a bill of quantities and cost estimates. All arrangements for getting contractors will be made at this stage. At the construction stage, the contractors will produce a building according to the cost and drawings from the design stage. Sarah (2012) opined that at the operations stage, the building produced by contractor will be operated and maintained. The communication and responsibility of each actor depends on the project procurement system. Base on the traditional procurement approach predominantly used in FCT Abuja and Niger State. The key participants in a building project are the client/financier, contractors, and sub-contractors and designers consisting of architect, engineers (structural, civil and service engineers), quantity surveyor, and a project

manager may be involved in some projects. These parties come together to form a temporary organization to undertake the project in hand for a specific period (Sarah, 2012). The summary of the key project participants and their responsibilities is given in Figure 2.5.

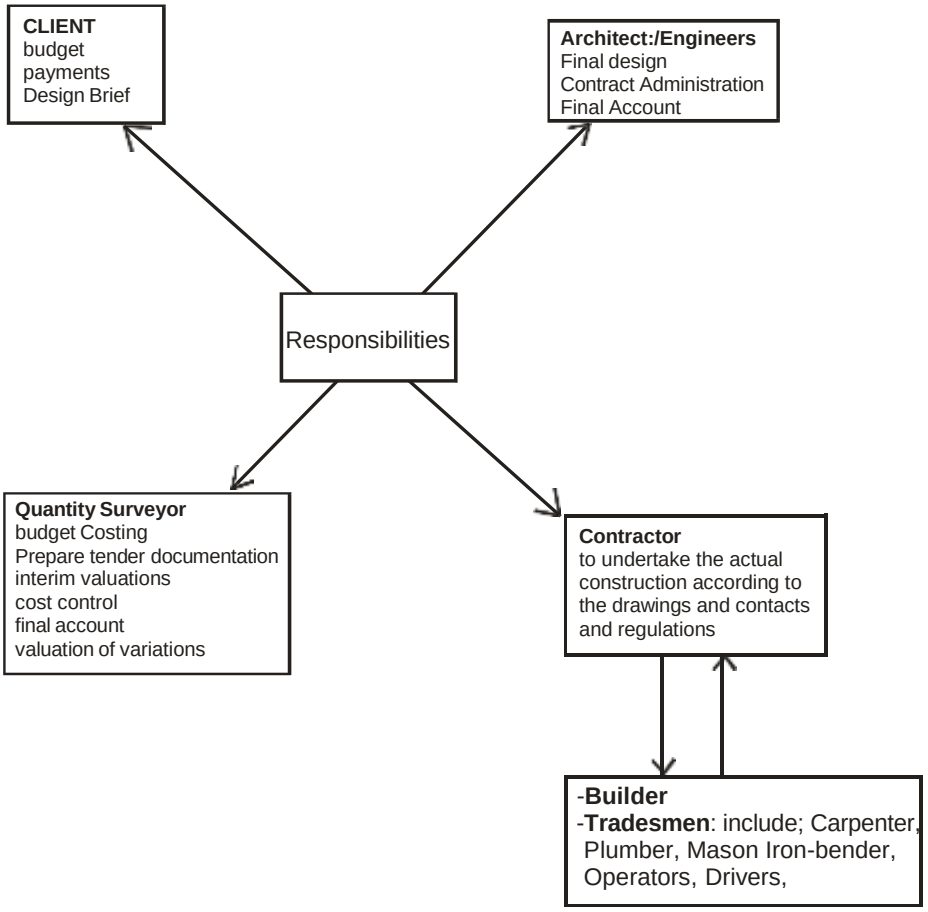

Figure 2.5: A summary of key project participants and their responsibilities by Sarah (2012).

2.2.2 Building construction company

Construction activities are believed to have been in existence as humanity, while building project in Nigeria started as early as 1930's. Construction activities were executed via Public Works Department (PWD) and Royal Army Engineers who later became (Nigerian Army Engineers). The only means of project execution then was through direct labour. However, British and Italian construction companies were first

to be engaged as contractors in the Nigerian construction industry in the 1940's Olowo-Okere (1985). Construction industry is also considered as labour intensive because, labour cost amounts to 40-65% of the overall cost of a project according (Rao *et al.,* 2015).

The construction companies in Nigeria operate majorly in two categories, multinational construction companies and indigenous construction companies as expressed in Idoro (2007) and Ogbu (2011). Ogbu (2011) and Ogunbanjo (2010) quoted the Nigerian Oil and Gas Industry Content Development Act 2010, definition of Nigerian indigenous company as one who registered under Companies and Allied Matters Act and having not less than 51% of Nigerian shareholding. Ogbu (2011), Ibrahim *et al.* (2014) explained that an indigenous construction company can be viewed as Nigerian owned firm, whose establishment and man power resources are sourced in Nigeria and their strength determine their level of operation in terms of project handling. Majority of government financed project and public-private-partnership project enjoy the engagement of foreign firms in execution of their project, due to adequacy of technically demand, skillful managerial competence, good planning, robust financial management, diversity in construction methods compared to indigenous firms who depend on individuals client for the award of building contracts (Enshassi, *et al.,* 2007; Idoro, 2007) studies.

The activities of the indigenous construction companies contribute significantly to the attainment of national development aim of providing infrastructure, employment and implementation of construction projects in Nigeria (Oladinrin *et al.,* 2012). Ibrahim *et al.* (2014) postulated that about 50-100% public and private clients involves Nigerian Indigenous construction companies in traditional and non-traditional procurement system. These greater percentages of projects executed by indigenous construction

company in Nigeria have largely experienced different level of accidents and injuries. Incidences of accidents and injuries are common occurrence on construction sites undertook by indigenous construction companies. However, there are no reliable figures that can attest to exact numbers of construction accidents in Nigeria, established that high rate of accident and injury were noticed among the indigenous companies at a ratio of 2 accidents per 100 workers and 5 injuries per 100 workers. As a matter of fact, the risks of serious injuries are almost three times higher than that of foreign contractors operating in the country (Agwu & Olele, 2013) Indigenous construction companies still represent the most dynamic and risky business in Nigeria because of the occurrence of accidents and fatalities compared to multinational companies.

Construction industry has been known for its physical nature due to the activities of works embedded in the process of building production. It can be argued that, the physical nature of the industry have direct impact on the operation of workers both in developed and developing countries (Ogundipe, 2017). Health and safety is a major factor in ensuring that construction project fully attains its objectives within the estimated budget with minor or no accident. In the same vein, Muhammad *et al*. (2015) opined that, workers compliance with health and safety regulations will have a positive influence in assessing workers quality delivery and productivity of construction projects. Dodo (2014) added that health and safety is an unavoidable aspect of construction process with the contributions of different tradesmen and professionals at all production stage. The researcher further argued that what determines indigenous construction company in Nigeria is the utilization of indigenous management staff and the joint ownership by the Nigerian. They are mainly seen as ‘medium and small size firms. However, irrespective of the category of their operations, construction industry

contributes largely to the economic outcome of every nations; by creating employment opportunity and incomes for the populace as asserted by (Myers, 2008; Ogundipe, 2017).

Construction company in view of this, Okolie and Okoye (2012); Muhammad *et al.* (2015) stated that multinational construction company are better than the indigenous construction company in quality performance based on this three criteria: 'workmanship', 'percentage of retention fees collected for the projects when completed' and quality of materials used for the projects. Multinational Construction Company' was considered to have better advantage to indigenous construction company in terms of performance and compliance. There exist some critical factors that need assessment. The operation of works both in the multinational construction company and indigenous construction company are being carried out by the same workers who are Nigerian. Idoro (2007) and Ogbu (2011) contended that multinational construction company have been considered to have better knowledge about safety regulations than indigenous construction company but it can be established that none of them have performed better than another in terms of safety practices and compliance.

2.2.2.1 Construction operatives in Nigeria

Construction industry always attract different participants working together to perform one tasks or the other which are interdependence and each of this operative input are required in meeting up clients satisfaction in all ramification. Wahab (1991) cited in Okolie and Okoye (2012) viewed site operatives as core that linked other construction resources together (materials resources, plants and equipment, and finance) to achieve project expected outcome. Assessment of projects success is incomplete without mentioning their contributions. In addition to site operatives' contribution to success

factor of construction industry, they also facilitates high productivity, less supervision, ensure company's competitiveness and reduction of accidents rate.

Site operatives are needed to perform specific tasks which could or/and could not be done mechanically. Currently, construction industry employs different categories of operatives on site for the executions of building production process. This includes: skilled and unskilled labours that undertake the following tasks; Masons and plasterers of walls, Carpenters/Joiners, Electricians, Painters, Glaziers, Roofers, Tillers, Floorers, Steel benders and fixers, Scaffolds, Plumbers, Plants and Equipment operators, Plants and Equipment among others. Their operations are under the supervision and control of the professionals in the built environment in ensuring that stated objectives of the project are met. Since each items of work comes with their associated risks. Ogbu (2011) specifically empowered registered builder to take up the responsibility of managing construction of building works including supervision of artisans and tradesmen. Previous studies conducted by Farhana (2014) and Adepoju *et al.* (2022) established the importance of site operatives and their vital contributions to the industry. They jointly opined that construction sector is the major users' of human resources after agriculture however, they are confronted with shortages of technically required of skilled craftsmen which affected productivity, work quality, projects duration and company's' profit.

Skilled Labour Operatives: Skilled labour is one capable of working independently and efficiently and turning out accurate working. Skilled labours are characterized by the virtue of their training. They involved in complicated tasks that need special skills, education, training and experience that are must be demonstrated on any given task (Kolo, 2015). The personnel under the skilled labour are of different abilities ranging from apprentices to trades foremen or supervisor. The apprentices can be regarded as

beginner who is willing and interested in learning a certain trade. The three possible avenues of training people are school, workshop and field. Those that falls under this category are Masons and plasterers of walls, Carpenters/Joiners, Electricians, Painters, Glaziers, Roofers, Tillers, Floorers, Steel benders & fixers, Scaffolds, Plumbers, Plants and Equipment operators, Plants and Equipment (Kolo, 2015).

Semi-Skilled Operatives: Semi-skilled operatives' are regarded as people who are able to work under adequate supervision and control. Though they have vast knowledge of the task to be undertaken but they cannot be regarded to as tradesmen. Semi–skilled operatives' are knowledgeable enough to follow instructions, take direction and safety rules and work with caution. This category comprises assistant operator, security guard, assistant electrician and iron-benders' helper (Kolo, 2015).

Unskilled Operatives: Unskilled operatives' are the workers that require no definite or specials skill to carry their tasks (Wahab, 1991). They are the category of operatives that have low skills or limited economic value for the work they performed. They are categorized by the levels of their wages and education at times because their task requires no specific training, experience, or education.

Their performance remained the yardstick to measure their wages, though due to familiarity or judging by the previous similar job experience it might help in setting a standard of work to justify their wages. Laborers on site fall into this category (Kolo, 2015).

2.2.2.2 Building construction personnel

The term building construction personnel refers to a person engaged in the physical construction of a building. These individuals could be either skilled or unskilled,

depending on the nature of work they are expected to perform on the building site (Kolo, 2015).

The researcher further his explain that Building construction workers perform a wide range of tasks, although virtually all these tasks require some form of training and experience, some can be performed with little or no skills. According to Kolo, (2015) the typical building site worker executes some basic tasks like:

- Load or unload building materials to be used on site.
- Clean and prepare construction sites by removing all the debris and potential hazards around the site.
- Operate machines used in construction works (concrete mixers, cranes among others).

Variety of trades are usually generally grouped as building construction works, they include the following:

i. Brick laying and concreting
ii. Carpentry and joinery
iii. Electrical installation and maintenance work
iv. Painting
v. Plumbing
vi. Roofers
vii. Metal work
viii. Tilling just to mention but few

2.2.2.3 The role of construction actors in construction

The client is the most important figure in the team. The client is responsible for financing and initiating all the activities involved to be performed on the construction site. The major contribution of the client is in specifying the needs to the designers

before the designs are prepared (Ogundipe, 2017). Clients also ensure that adequate financial reimbursements are made before the commencement of projects stating their limits in spending.

Consultants mainly deal with quality and cost considerations; they ensure that the projects are executed within the financial limits set by the clients and to the desired standards set. Cost analysis is crucial to the success of every project, thus clients require adequate cost analysis from the consultants (Ogundipe, 2017).

Workers role in the construction industry is primarily to carry out the work allocated to them on site; they utilize the materials and equipment for the success of the project in order to achieve completion in good time and cost (Ogundipe, 2017). The workers literarily are responsible for the physical erection of the structures on site.

2.2.3 Safety in building construction site

Safety is an economic as well as humanitarian concern that requires proper management control. Benefits of safety and health may include: less injuries, less property damage, less down time, improvement in morale, enhance industrial relations, increased productivity, reduced cost and enhanced quality (Alfred & Pao-Chi, 2019). Other benefits include: less compensation insurance, fewer hidden costs, improved supervisor morale, increased efficiency, and improved marketability. Most accidents on construction sites are preventable through implementation of an effective safety program. Unsafe conditions and accidents are usually a sign that something is wrong in the management system. Safety and health must be managed in the same manner that other aspects of a company are managed. Although an effective safety program can prevent or reduce injuries, not all contracting organizations implement safety programs.

Good safety performance and high productivity from the opinion of Ednana (2020) are compatible and that safety should not be sacrificed in an endeavor to enhance productivity. Good safety performance is also related to the management style and that applying excessive pressure by any means to the workmen resulted in increased injuries. The productivity of crews may be adversely impacted by a worker injury. For instance, a crew working in the vicinity of the accident will probably work less productively as a result of the injury. Initially, these crews may simply stop work in order to observe the activities surrounding an injury. The crews may be less productive because of discussions with fellow workers concerning the accident.

Safe and healthy working conditions do not happen by chance. Employers need to have a written safety policy for their enterprise setting out the safety and health standards which it is their objective to achieve (International Labour Office, 2012). The policy should name the 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 such are carried out.

The International labour office further precedes that; the safety policy should deal with the following matters:

- Arrangements for training at all levels. Particular attention needs to be given to key workers such as scaffolders and crane operators whose mistakes can be especially dangerous to other workers;
- Safe methods or systems of work for hazardous operations: the workers carrying out these operations should be involved in their preparation;
- The duties and responsibilities of supervisors and key workers;
- Arrangements by which information on safety and health is to be made known;

- Arrangements for setting up safety committees;
- The selection and control of subcontractors.

2.2.3.1 Safety practice in building construction

Safety can be viewed as a point at which all associated risks with a particular job are well managed in a reasonable manner. Safety has been defined as unique event that is paramount to continuous attainment of productivity. In the same vein, safety should focus on curbing accidents at work setting and its negative effect on the workers in all manners (Ahmad *et al.,* 2016). Management of safety in construction project reveals that adoption and compliance with health and safety provision served as catalyst in optimizing construction production process. Without compliance to health and safety practices, more accident will result in pains, accidents and legal actions thereby escalating production cost (Idubor & Oisamoje 2013; Dodo, 2014; & Umeokafor *et al.,* 2014). Safety practices are parameter to measure successful project delivery which is most paramount to the client because they greatly influenced in achieving efficiency and effectiveness amongst professionals and even workers in the construction industry (Famakin & Fawehinmi, 2012).

The anomalies as seen in the construction firm's failure to comply with minimum requirement of health and safety practices might cause the victim waste of time, also loss of money to the firms. Although construction firms may be covered with life assurance for their staffers from certain direct costs resulting from injury suffered, however some cost may be involved which cannot be insured against, such as loss of trained personnel, loss of production hours due to other operatives stopping the progress of the work out of concern or assisting the injured persons (Dodo, 2014). Thus, the lack of adherence to safety practices will delay the production process and invariably affect sustainable development.

Several attempts have been made by the construction industry towards improving its safety performance. However, the paradigm shifts from monitoring safety performance to preventive measures of improving safety performance is necessary. Some developing nations like Nigeria are among the nations that lack adaptive laws and regulations on health and safety practices. Management of safety practices can only be effective when it is approached from socio-humanitarian perspective, and economic perspective. (Muhammad *et al.,* 2015).

2.2.3.2 Safety facilities in building construction industries

Safety facilities in building construction company according to Ogundipe (2017) can be categorized into welfare and protective facilities as listed below.

A. Welfare facilities

   Supply of water

   Changing room

   First aid box

   Canteens

   Toilets

   Sick bay

   Washing and bathing facilities

   Provision of safety measures

   Ladder

B. Protective facilities

   Helmet or hardhat

   Safety boots

   Safety wear

   Safety glass or face shield

Respirator

Gloves

Ear protective wears

Safety belt

Breathing protective wears

2.2.4 Adequacy of safety facility in building construction company

The provision of welfare and safety facilities provisions at construction sites play an essential role in worker's well-being and health (Health and Safety Executive (HSE) (2010). The Construction Design and Management Regulations (CDMR) 2007 stated that, adequate welfare and safety facilities on construction sites can lead to direct impact on increase productivity of workers and profit. However, inadequate safety facilities can result in low output as well as loss of profit when not provided to workers in the process of working. Construction Design and Management Regulations (CDMR, 2015) posits that construction site needs to be provided with minimum welfare and safety facilities such as suitable toilet and washing facilities, potable drinking water, protective safety wears and equipment, facilities for storage and rest. It was revealed in Dok Yen *et al.* (2018) that Labour Act 651 of Ghana, Section 118 makes it mandatory for employers to provide welfare facilities for construction site workers, nevertheless the basic requirements for welfare facilities are often inadequate and sometimes neglected in the worst case by contractors. Even though, Welfare facilities for workers such as a place to eat food and snacks, wash and clean their hands, visit wash room, a place to relax to recover from fatigue and so on can lead to increase worker output, it can as well turn to have a negative effect on workers if they are not adequately provided and maintained in a good state (Hiba, 1998).

Clients through their consultants must ensure that their contractors have arrangements put in place to provide adequate welfare facilities for construction workers. If the work is noticeable (that will last more than 30 days or will involve more than 500 person days of work) then they must ensure that construction work (including demolition) does not start until suitable welfare facilities are in place (CDMR, 2007). Also, it is important for contractors to ensure that suitable, adequate welfare facilities are provided from the start and are maintained throughout the construction phase for workers under their control (CDMR, 2007).

2.2.4.1 Planning safety facilities

The availability of safety facilities and their location on site and regular maintenance must be considered at the planning and preparation stages of every construction project before construction work (including demolition) starts. When planning safety provisions for construction sites, it is important to consider for instance; the nature of the work to be carried out as well as the health risk factors that are associated with provision of showers where the project involves hazardous substances or very dirty work (For instance Sewer maintenance, dusty demolition activities, works with contaminated land or concrete pouring); the proximity of safety facilities to workers; The project duration and number of different locations; The total number of people needed for the project; The cleaning and maintenance of the safety facilities and so on and so forth (CDMR, 2007). In addition, the researcher further opined that, extra-mural facilities are the facilities offered to the workers outside the factory. They include better housing accommodations, indoor and outdoor recreation sports, and educational facilities among others.

Safety facilities can be classified under two types namely; intra-mural and extra-moral. Intramural activities consist of facilities provided within the organizations or sites and

this includes sick bay, supply of water, washing and bathing facilities, changing rooms, canteens, provision of safety measures, tasks which assist in improving the conditions of work, and such alike (Suresh & Vijayarani, 2015).

The minimum safety facilities required for construction sites have been broken down into five (5) main parts namely: sanitary conveniences, washing facilities, drinking water, changing rooms and lockers, and finally facilities for rest (CDMR, 2015). From the foregoing, it is evident that safety facilities argument safety facilities.

2.2.4.2 Personal protective equipment (PPE)

There should be provision for Personal protective equipment (PPE). PPE is a preventive safety wears against the occurrence of injuries at work. According to the International Labour Organization (ILO) (2017) codes of practice, it is important for employers to make available personal protective equipment (Safety Wears) appropriate for the nature of work to be carried out. Safety wears should fit perfectly and be suitable to work with. In order to properly use safety wears the nature and degree of the anticipated risk must be studied, known and then selection of appropriate safety wears should be in conformity with the specified standards. Users must be trained on right usage and adequate maintenance must be provided for safety wears after use. For example coverall, Google and safety boot (Ogundipe, 2017).

Ogundipe (2017) further opined that, safety can be achieve through systematic approach (engineering controls, administrative controls and implementation of personal protective equipment usage) or hierarchy of control (elimination, substitution; isolation; administrative controls and personal protective equipment). Systematic approach to occupational health safety management system offers better approach than the five

traditional treatment options agitated by the hierarchy of controls. Safety wears can enhance the safety of worker as indicated in some of the past research studies.

The choice of selecting appropriate safety wears according to Ogundipe (2017) is based on the anticipated hazards. However, some of the safety wears for the construction work include: hardhat, safety glasses or face shield, respirator, body protective wears, gloves and safety foot wears.

2.2.5 Utilization of safety facilities in building construction industry

Safety management and accident prevention remains a top priority for the construction industry. Personal protective equipment (PPE) is a preventive safety wears against the occurrence of injuries at work. According to the International Labour Organization (ILO) codes of practice, it is important for employers to make available personal protective equipment (safety wears) appropriate for the nature of work to be carried out. Safety wears should fit perfectly and be suitable to work with. In order to properly use safety wears the nature and degree of the anticipated risk must be studied, known and then selection of appropriate safety wears should be in conformity with the specified standards. Users must be trained on right usage and adequate maintenance must be provided for safety wears after use.

Unsafe condition according to Farooqui *et al.* (2007) in Ogundipe (2017) opined that, unsafe conditions coupled with the use of improper safety wears contributed to high rate of accidents in construction industry. In the same vein, Abdelhamid and Everett (2000) believed that, continuous monitoring of safety wears compliance and framing comprehensive purchase policy are the responsibility of safety department. In Ogundipe (2017) study, safety wears was at the last stage of hierarchy of controls and its enforcement will be implemented after engineering and administrative controls.

Management is responsible for training, monitoring and compliance with the use of safety wears in ensuring workers safety on construction sites. The provision and use of safety wears can be significant element in terms of accident prevention and control on construction sites. Ogundipe (2017) reported that workers ignorance, negligence, carelessness and over-confidence were the major perceived reasons workers disregard wearing of safety wears properly. Safety according to Winder and Makin (2006) and Prasad and Rao (2013) in Ogundipe (2017) opined that, safety can be achieve through systematic approach (engineering controls, administrative controls and implementation of personal protective equipment usage) or hierarchy of control (elimination, substitution; isolation; administrative controls and personal protective equipment). Systematic approach to occupational health safety management system offers better approach than the five traditional treatment options agitated by the hierarchy of controls. Safety wears can enhance the safety of worker as indicated in some of the past research studies.

Abdelhamid and Everett (2000) conducted depth study the causes of low use of safety wears into human and physical elements. Human elements neglected to wear individual defensive hardware such as: safety wears, clowning around, working at risky speed, individual component, evacuate security gadget, overhauled moving and empowered wears, took hazardous position or stance, and utilized inadequate device or hardware, and other dangerous activity. While, physical elements neglected to wear individual defensive hardware such as: deformities of mischance source, dress or attire risk, ecological danger, fire danger, dangerous course of action, risky strategy, housekeeping peril dishonorable task of work force, insufficiently protected, open danger, and other hazardous conditions.

Safety wears is not necessary, not adequate, and inconvenient were some of the reasons responsible for non-compliance with effective use of safety wears among the workers. Osonwa *et al.* (2015) revealed the need for training on the use of safety wears this could create awareness on the implications of inhaling wood dust on workers' health.

2.2.6 Types and function of safety facilities in building construction sites

These are some Personal protective equipment (Safety wears) for construction work. The choice of appropriate safety wears is based on the anticipated hazards. However, Ogundipe (2017) list some of the safety wears for the construction work to include: hard hat, safety glasses or face shield, respirator, body protective wears, gloves and safety foot wears.

Head protective wear

Safety helmets or hard hats are the name of safety wear used to protect human from head injury of falling or flying objects, or due to striking against objects or structures". Most of the safety Regulations clearly includes the use of safety helmet before visitor or workers can gain entrance to construction site, especially where the possibility of falling object is high to avoid head injury. Safety helmet has reinforced ribs on top for impact strength, a rain gutter round the side and rear to guide water away, and can be fitted with a chin-strap. Helmet also has an adjustable in-built safety visor, which can be easily pushed up out of the way if required. The whole helmet is light and quite comfortable (plate 1) (Ogundipe, 2017). Manufacturers have adapted hardhats so that ear protection and face shields may be easily attached. Hardhats are adjustable so a liner can be worn during cold weather. A chin strap is advantageous when work involves bending and ducking. It also helps secure the hardhat to the head when full-face masks are worn. Face shields that attach to hardhats provide added protection. A combination that leaves no gap between the shield and the brim of the cap is best

because it prevents overhead splashes from running down inside the face shield (Ogundipe, 2017).

Plate I: Hard Hat

Eye protective wear

A face or clear goggles, shield and other suitable gadgets must be use used when there is possibility of physical hazards or the eyes is being exposed to face injury from airborne dust or flying particles, in particular during welding, flame cutting, rock drilling, concrete mixing dangerous substances, harmful heat, light and other hazardous work. There should be standard safety wear for respiratory protection that has half-face mask with no face shield. Both safety glasses/goggles and a face shield are recommended so far they are transparent. However, according to Mohammed (2018) it is not advisable to wear contact lenses in situations where workers are to use hazardous chemical. Face shields (plate II) and goggles must be worn in combinations of a situation where work operations such as grinding that involves flying particles or corrosive materials are being carried out.

Plate II: Eye Protective Wear

Ear protective wears

Ear protective wear is good for workers that are exposed to high levels of noise, which could lead to irritability. Noise reduces workers' ability to concentrate and causes hearing damage which can lead to accidents. Earplugs or muffs help when noise coming from a particular task becomes unbearable and problematic, such as working around heavy machinery and impact tools (Paul 2010). Hearing protection gadgets (Plate III) must be used, especially for persons working in areas such as high-volume pumps, power drilling machine, skid units, pile drivers, jack hammers, impact tools, grinders, saws.

Plate III: Ear Protection Wear

Foot protective wear

Building construction process generates lot of waste on sites, workers are prone to accidents due to penetration of sharp objects like nails which have not been knocked down and crushing by falling materials, this could be drastically reduced with the use of foot protective boot (plate IV). The type of safety shoes or boots to be used depend absolutely on nature of the work (the presence of ground water on construction sites), but all safety footwear must have an impenetrable sole and uppers with a steel toe-cap. There are two available styles of safety boot, they are called: pullover and shoe boot. Pullovers may be inexpensive enough to be considered disposable; otherwise they must be completely decontaminated. With chemical resistant boots, the pant leg should be

outside and over the boots to prevent liquids from entering. All boots are expected to have steel toe while steel shanks must be included for the workers expected to climb ladders or travel over sharp protruding objects (Ogundipe, 2017).

Plate IV: Safety Foot Wear

Hand protective wear

Protective glove is highly recommended for a good tactile sense, elasticity and dexterity and as well provide necessary chemical resistance. The gloves (Plate V) must have ability to resist puncturing, must not be slippery, easy to use and removed. They are made of materials such as cotton, latex, nylon or leather. The nature of work anticipated determine the appropriate kind of gloves that must be used. The only place gloves may not be used are situations where the gloves might get tangled up in moving parts of machinery such as drill spindles and revolving cutting tools. The hands are as susceptible to contamination as the feet (Kolo, 2014).

Plate V: Safety Hand Glove

Body protective wear

Protective clothing against bodily damage from hazardous substances, gases, or vapors is available in a variety of styles and materials. The materials can be made of Tyvek which are disposable or Nomex which are durable. Both are available as overalls suitable for field use. As the risk of hazards to the body increases, so also the level of protection needed. A splash suit (Plate VI) made of PVC is suitable for a liquid such as an acid or base or when there will be minimal contact with organic materials. Some are inexpensive enough to be disposable. If the material is more toxic, then more protection must be utilized. Splash suits similar in design to the PVC splash suits are good barriers against toxic hazards. These are made of neoprene and butyl rubber. Toxic vapor/gases require the most complete protection, the best being fully encapsulating suits. The suit must not allow any penetration or permeation. Zippers must be properly sealed and seams properly connected and sealed to protect against vapors (Osonwa *et al.*2015). Fully encapsulating suits also require the basic safety items such as safety boots and hardhat, along with a source of breathing air.

Plate VI: Body Protective Wear for corrosive chemical

i) Orange safety vest: Is worn where visibility is necessary.

ii) Cloth coveralls: they are used to protect street clothes from getting soiled and are not for protection against exposure to hazardous material. They are made with an open weave that allows particles, liquids and vapors to pass through easily.

iii) Chemical splash suits: There selection is based on the hazard anticipated (plate VI)

iv) Tyvek suits: Offers protection against particulate contaminants and other nuisances. It provides limited protection against liquids.

Safety belt

Working at heights mighty be challenging with possibility of falling. However, safety regulations require employers to adopt basic safety precautions including the provision of suitable scaffolding, safe access and egress and the erection of suitable guardrails at hazardous locations (Ogundipe, 2017). All of this must be used with safety belt.

Plate VII: Body Protective Wear Safety Belt

Breathing protective wear

An air-purifying respirator (plate viii) is a protective gadgets used to control airborne contaminants that cannot be reduced to safe levels by engineering control. It allows

work to be done in confined spaces. An emergency escape pack should be used in conjunction with an air-purifying respirator (Kolo 2014).

Plate VIII: Breathing Protective Wear

2.2.7 Procedure for safety measures in construction site

Safety plans

Management of any construction firm has the responsibility of developing a comprehensive and written safety program that is performance oriented. The information should include the basics of personal protective equipment, the proper use of tools and power equipment, safe work practice, company policy on safety, safety responsibilities and emergency procedure. This document must be made available to every worker on site and adherent to it must not be compromised. The responsibility of the safety personnel shall be to draw up a safety plan, setting out the rules applicable to the construction site, and shall make any adjustment to the plan, ensure effective distribution and use of safety equipment (Selvam, & Krithika, 2019).

Safety training and meetings

Safety training is an essential part of any safety and health program. Safety personnel and site workers should be trained in hazard identification, control and method of encouraging safe practices. The safety training and meetings must emphasis the project's safety requirements, review past activities, plan ahead for new operations. Discuss the causes of accidents on site and ways of preventing future occurrence. This training should be provided in the language well understood by the workers (Mohammed, 2018).

First-aid and medical arrangements

First aid facilities must be provided on site regardless of the size of the project and the number of workers on site. In case of any injury such as cuts, strips or trips; prompt treatment with first aid facility can help prevent further aggravation of such injury. The employer should be responsible for the provision of first aid facility and personnel at all time on site.

Management policy

The type of management policy or commitment to safety at workplace is very essential to the prevention of accidents. The various commitment of construction management are in drawing up of an effective safety plans, provision of protective equipment for all site workers and personnel, encourage safe working habits, incentives for safety and regular review of accident prevention or safety program. All of these accident preventive measures and many more are required on site to effectively prevent or reduce the occurrence of accident on building sites. According to (Selvam, & Krithika. 2019) Health and Safety Executive (H.S.E.) and Occupational Safety and Health Administration outline preventive measures as:

i. Wearing clothes that are appropriate to the work and weather condition on site.

ii. Wearing of hand gloves.

iii. Wearing of work traction boots at all times on site.

iv. Wearing of hardhats or helmet at anywhere on site.

v. Provision of eyewear or goggle for welding purposes

vi. Constant inspection and assessment of equipment, plants, tools and other site materials before use.

vii. Organizing effective safety training for all site workers and personnel whether on site or off site.

viii. Provision of effective first aid facility and personnel on site.

ix. Provision of barriers, signs or reflector around dangerous areas on site such as barrier around trench.

2.2.8 Challenges encountered in the effective utilization of safety facilities in building construction sites

Accidents do not happen, they are caused. For every accident that occurs there exists a remote reason why it happened. Various researches have been done pertaining this topic with various conclusions reached. A variety of causes exist for accidents which occur on building construction sites, as such it becomes the responsibility of the personnel in charge of the site to recognize the cause when it occurs and proffer effective ways to tackle them (Siriwardena *et al.*, 2006). Natural phenomenon referred to in Nigerian construction industry as "Acts of God" also play some role in causing construction accidents. They include rains, earthquakes, flooding and landslides. The existence of these is capable of disrupting construction activities and causing accidents. Man has no control over the occurrence of this natural phenomenon, in the event of their occurrence construction activities are automatically suspended. During the rainy season, workers

engaged at height could lose balance as a result of the slippery scaffolds from the rains; hence Adeniye. (2001) suggested that it is much easier to work on construction sites during the dry season than the rainy season.

Workers accidents on construction sites can be attributed to two aspects, unsafe acts and unsafe conditions (Siriwardena *et al.,* 2006). Unsafe acts are controlled by the construction worker such as using faulty equipment to work, disregarding posted warning signs on site among others. Unsafe conditions (mostly found across all construction sites) include insufficient lightning on site, poor ventilation just to mention but few (Kolo, 2015). Aniekwe (2007) identified that the factors leading to accidents on construction sites as:

i. Use of faulty tools.
ii. Non-compliance to standard safety rules and regulations.
iii. Improperly maintained and inadequate scaffolding.
iv. Lack of experience.
v. Improper handling and storage of flammables.
vi. Poor handling of tools and equipment.
vii. Worker fatigue and boredom.
viii. Improper Supervision.
ix. Management attitude.
x. Workers operating environment.
xi. Natural causes.
xii. Inadequate management of work environment.
xiii. Faults in design details and specifications.
xiv. Faulty construction techniques.
xv. Workers physical condition.

xvi. Lack of Job satisfaction.

xvii. Monotony (exposure to a particular job constantly).

Accident on construction sites according to (Zaynab & Hijab, 2012) can be caused by the following:

i. Lack of safety training.

ii. Poor understanding of the risks associated with the work.

iii. Influence of unsafe behaviour by workmates.

iv. Over confidence.

v. Shortage of equipment.

It should be pointed out that all these researches are broadly based on the construction industry in general be it road construction, bridge construction, building, and so on. However, it is generally based on all civil construction works, but this research will focus primarily on the building construction industry in order to fashion out issues associated precisely with the sector. Accidents are generally common in the construction sector worldwide; these accidents hinder the progress of activities on construction sites. They result in injuries or even death of the workers and also financial drain on the part of the construction firm (Ameachi, 1990).

Kolo (2015) listed some major factors capable of causing accidents among workers on sites. The factors include:

i. Carelessness.

ii. Effects of alcohol fatigue or shock.

iii. Negligence.

iv. Lack of knowledge to handle new materials and techniques.

v. Deliberate risk for bonus or speed.

vi. Lack of education.

Elufidipe (2009) was of the opinion that occurrence of accidents is either because of unsafe working conditions or unsafe acts. Some accidents happen as a result of employers assigning some jobs to employees (workers) who are not trained to handle such particular jobs without supervision. Accordingly, unsafe acts on sites could be summarized as follows:

i. Failure to use safety attire or personal protective equipment.
ii. Unsafe loading, arranging and placing.
iii. Use of improper tools or equipment.
iv. Taking unsafe positions or postures.
v. Hazardous ways of handling equipment or tools.

2.2.9 Strategies for enhanced utilization of building construction safety facilities

There are different ways for effective utilization of safety facilities in building constructions site. Paul (2010) explained that the use of Personal Protective Equipment (hard hats, safety glasses and safety shoes) in all drilling and blasting areas reduce accidents in construction site. The following precautions should be taken when:

1. Drilling

i. A competent person shall inspect all drilling and associated equipment prior to each use. Correct equipment defects affecting safety before the equipment is used.
ii. Inspect the drilling area for hazards before starting the drilling operation.
iii. Do not allow employees on a drill mast while the drill bit is in operation or the drill machine is being moved.
iv. When a drill machine is being moved from one drilling area to another, secure drill steel, tools, and other equipment, and place the mast in a safe position.

v. Do not drill blasting holes through blasted rock (muck) or water.

2. Haulage of debris

i. A competent person shall inspect haulage equipment before each shift.

ii. Correct equipment defects affecting safety and health before using the equipment.

iii. Safely remove debris from all surrounding areas immediately after each blast.

3. Blasting - use of explosives

i. Only authorized and qualified persons will be allowed to handle and use explosives on this project.

ii. Smoking, firearms, matches, open flame lamps, and other fires, flame or heat producing devices and sparks shall be prohibited in or near explosive magazines or while explosives are being handled, transported or used.

iii. No person shall be allowed to handle or use explosives while under the influence of intoxicating liquors, narcotics, or other dangerous drugs.

2.2.9.1 Accident prevention on building construction sites

Accident prevention on building construction sites involves predicting the occurrence of future accidents and the perceived characteristics of these accidents given the immediate nature of the site and surrounding environment (Kolo, 2014). Construction accidents on building construction sites can be effectively checked if the following measures are effectively enforced on sites:

1. **Site safety precautions**: The task of providing adequate safe site environment lies with the main contractor (Sarah, 2012). In 1958, building regulations were amended, the amendment applied to all works in the construction industry. On the job safety training courses should be introduced on the construction sites (Construction Design and Management Regulation, 2007). These will help reduce the amount of accidents on sites

as the workers will be educated on the dos and don'ts as well as the best ways to go about their works.

2. **Site discipline**: Respect and obedience on site can help reduce to a barest minimum amount of accidents on sites. There should be no hurry while working with mechanical plants. Break periods should also be strictly obeyed to ensure that the operators refresh themselves before continuing.

2.3 Review of Empirical Studies

Charles *et al.*, (2019) conducted research on Appraisal of the Challenges to Ensuring Occupational Health and Safety Compliance within the Nigerian Construction Industry. The study used three research objectives and three research hypotheses. The study adopted the descriptive form of research to meet the objectives of the study. Close-ended questionnaire was used for collecting data from respondents comprising of construction professionals such as builders, quantity surveyors, engineers and land surveyors within Lagos state Nigeria. The questionnaire was administered using a convenience sampling method because it is convenient, quick and inexpensive. A total of one hundred and thirty-eight (138) were used for the analysis out of one hundred and sixty-eight (168) that was distributed to the respondents. The questionnaire had two sections with the first section examining the level of compliance of the respondents to occupational health and safety regulations; while the section looked at challenges of ensuring occupational health and safety on construction site.

The response from the questionnaire was analyzed using SPSS (statistical package for social science) version 24. Analytical tools like mean item score and factor analysis were used to analyze the data. The findings revealed that construction workers compliance to health and safety requirements is below average while the factor analysis

showed inadequate safety equipment, low awareness to occupational health and poor compliance to health and safety requirements as the major challenges hindering the compliance rate. The study recommends that implementation of the use of innovative measures and hi-tech devices such as radio frequency identification for effective monitoring of construction workers. It also recommends the involvement of construction workers when making the health and safety policies. This study contributes towards improving the occupational safety experienced on construction sites within the country.

The research reviewed and the present research works are both on health and safety issues involving workers on building construction sites, they used structured questionnaires, the differences between the study are; the location. The reviewed study was in Lagos while this research is in FCT, Abuja and Niger State. The use of characteristics of subjects, the reviewed research used 168 while this research work used 181 and the research reviewed use random sampling while this research used proportional stratified random sampling to drawn 5% of builders and tradesmen in FCT, Abuja only.

Manase *et al.* (2019) carried out a study on accident prevention on construction sites, towards a new approach. The purpose of the study was to put forward a methodology for accident prevention on construction sites. Six research questions and six hypotheses were involved in the study. The study adopted a descriptive survey research design. Questionnaire was used as instrument to collect data from 137 respondents with the help of two research assistants. The data collected for the study were computed using mean and standard deviation for answering the research questions, t-test and Crombach Alpha (α) reliability technique was used for testing the three hypotheses at 0.05 level of significance. The finding revealed that most accidents occur as a result of poor planning

and design at the early stages of the construction project. The finding of the study revealed that all the stakeholders in the construction process have a responsibility to safety design and construction procedures. It was therefore, recommended that considerations should apply to design, construction and maintenance works and should not be seen as restricted only to design work specifications.

The study reviewed related to the present study because it identified the accident prevention on construction sites, towards a new approach. While the present study focus on identifying the adequacy and utilization of safety facilities in building construction sites in FCT Abuja and Niger State, Nigeria. Although, both studies adopted common research design and instrument for data collection which were recognize similar to the study adopted by the present study. However, the present study differs in purpose of the study, statistical tool and geographical area.

Tambari (2018) conducted a study on factors that influence the performance of safety management programmes in the Ghanaian Construction Industry. The objectives set to achieve this aim include identifying the safety elements incorporated in the safety programmes of construction firms, and determining the factors that negatively influence the performance of such elements. For objectivity, a quantitative survey was conducted among safety managers of 60 building construction firms located in the Kumasi and Greater Accra regions of Ghana. The questionnaire was structured into three parts, which sought the respondents' profile, identified the safety elements incorporated in the firms' safety programmes, and identified the factors that negatively influence the performance of the safety elements. Following a detailed literature review, the respondents were asked to rate 13 elements and 17 factors on a Likert scale. Data was analyzed using the Statistical Package for Social Sciences (SPSS) Version 22. In

addition to determining the reliability of the various constructs, the modes and standard deviations were obtained.

The findings revealed that all of the 13 elements were incorporated in the firms' safety programmes. The key elements identified include 'providing safety managers on site'; 'providing written and comprehensive safety and health plans'; 'introducing project-specific training and regular safety meetings'; 'providing safety and health orientation training', and 'involving employees in safety and evaluation'. The findings further revealed that 16 of the 17 factors negatively influence the performance of the firms' safety programmes. The factors identified were, 'insufficient communication of safety programmes'; 'lack of workers' self-protection and awareness'; 'contractors ignoring safety, due to the time pressures of the project schedule'; 'poor personal attitudes towards safety', and 'ineffective laws and lack of enforcement'.

The study were related in research design employed because both study employed the use of descriptive survey research design and also both studies used questionnaire for collection of data. However, they differ in the area of study as the reviewed study was in Ghana while the present study is being carried out in Nigerian. It was concluded that both studies differ because Enshassi *et al.* (2007) study was on random sampling techniques and also the reviewed work was on factors influencing the performance of safety programmes in construction industry while this present study is on adequacy and utilization of safety facilities.

Ogundipe (2017) conducted a research on safety practices and workers performance in construction sites in Lagos State, Nigeria. The aim of this study was to determine the

level of compliance in the use of safety wears and other safety control systems with a view to enhancing safety performance and workers' productivity on construction

projects. A total of one hundred and twenty eight (128) copies of questionnaire were administered to participants with years of experience on construction management in Lagos State, Nigeria. Data obtained based on snowball and random sampling techniques were analyzed with the aid of Statistical Package for Social Sciences (SPSS) version 23 using Mean Scores, Relative Importance Index (RII).

The significance of each of the associated variables as impacted on construction workers safety practices on buildings project were determined using Independent Samples Test and Mann-Whitney U Test. Descriptive outcome of the statistical analyses showed a high prevalence need of safety practices. The findings of the study established dissatisfaction with effective use of safety wears and its implementation among site operatives because workers find it difficult to adapt to it being against their traditional practices(RII=0.776), unethical practice of workers due to human attitudinal peculiarities (RII=0.766),inadequate engagement of safety managers on sites (RII=0.764), inadequate engagement of safety managers and ineffective supervision on site(RII=0.762) as well as poor communication between site managers and site operatives (RII=0.750), all are factors preventing effective use of safety wears among the categories of respondents sampled.

The study concluded based on Mann-Whitney U Test result on safety improvement measures and control systems available for safety practices and workers performance on construction sites include: the use of safety audio, video and visual displaying gadgets on site, daily check of scaffold and ladder among others, inclusion of safety matters from the planning stage, setting safety guidelines into conditions of contract, reward workers that exhibit excellent safety performance, conduct in-house safety training were found to be statistically significant with medium effect. The study recommend minimum of one safety managers on every construction sites.

The study reviewed is related to the present study in the area of effective use of safety wears among construction site operatives. The study were also related in the type of research design employed because both study employed the use of descriptive survey research design and also both studies used questionnaire for collection of data. However they differ in the area of studies as the reviewed study was in Lagos while the present study is being carried out in FCT Abuja and Niger State. Although, both studies use sampling techniques and also the reviewed work used Test, Mann-Whitney U Test while the present work used ANOVA.

Uduakobonge *et al.* (2016) conducted research on the effect of lack of adequate attention to safety measures on construction site. The purpose was to examine the most common type of accidents on construction sites, and to examine the effect of lack of adequate attention to safety measures on construction sites. The study adopted the descriptive survey research, the population comprised 411 respondents. The data collected were analyzed using mean, standard deviation and t-test, correlation ratios and Pearson Product Moment Correlation was used to determine the reliability co-efficient of the instrument. The findings of the study also provided insight into the effect of lack of payment of attention to safety issues on construction sites. Demonization of workers/ reduced morale rank as the most severe effect. Negative impact on reputation of firm, increased project cost and payment of settlement of injury/death claims were also considered as having severe impact.

The study according to the author, identified effect of lack of adequate attention to safety measures and the areas where safety measures needed improvement for effective accident control method. It relates to the present study as the study also identified the safety procedure in construction site and accident control method in addition to determining the areas in building construction site that need safety improvement for

effective works activities in the site. Both studies used a descriptive survey research and means for data analysis. Although, both studies differs base on the method null hypotheses was tested and also the sampling techniques chosen by the two studies

Kolo (2015) carried out research work on Safety Issues Involving Workers on Building Construction Sites in Nigeria: An Abuja Study. Four research question and hypotheses were used for the study. A descriptive survey research was adopted where questionnaire Building Construction Site Employer/Company Staff Assessment on Safety Issues Involving Workers Questionnaire (BCSECSASIIWQ) was used as instrument to collect data from 80 respondents. The research was validates by Two engineers and 1 contractors. Reliability test was carried out in Minna, Niger State. The mean and standard deviation was used to answer the research question while t-test was used to test the null hypotheses.

The finding of the study Nigerian workers jump into the construction industry without gaining adequate training, they tend to learn on the job. Workers engage in site works paying little or no attention to their personal safety, they work with the mindset that as long as they are being paid their allowances they are ready to work. They tend to ignore the poor safety standards on site as long as they have a source of income; they intentionally overlook situations when their rights are being violated by their employers. It was recommended amongst other that the government should ensure all construction sites erect safety signs before construction can commence. Pictorial books/leaflets presenting different hazardous working conditions should also be provided for the workers, these books should contain just pictures so it would be easily understood by even the illiterate workers. The federal ministry of labor and the Nigerian institute of safety professionals who are the agencies with oversight functions of ensuring strict implementation of the regulations should be strengthened and provided with the legal

backing to carry out their roles effectively, accident documentation on these sites should be done effectively.

Both the research reviewed and the present study focus on safety issues involving workers in building construction sites, although the used structured questionnaires was common among both studies. The basic differences between the two studies are; the location that is North Cyprus while this research is in Nigeria. The number of questionnaire, the reviewed research used 80 while this research work used 181 and the research reviewed use random sampling while this research used proportional stratified random sampling to drawn 5% of builders and tradesmen in FCT, Abuja only.

Kadiri *et al.* (2014) conducted a study on Causes and Effects of Accidents on building Construction Sites. The purpose of the study was to examine the major causes of accidents and suggests ways of mitigating these accidents on construction sites. The study was a survey that covers entire FCT Nigeria.70 numbers of questionnaires were administered amongst reputable construction firms in FCT Abuja out of these 70 questionnaires administered, 15 of them were multinationals, which represented 21.45%, and 20 were large scale indigenous firms which represented 28.5% and 335 were small scale indigenous firms representing 50%. Mean and standard deviation and ANOVA was used to analyze the study. The findings of the research Identify lack of attention from leaders as 1st with a relative importance index of 0.92, this indicates that workers need constant supervision on site with regards to ensuring safety on construction sites. Therefore, the role of leaders on site is extremely important on construction sites in preventing accidents and reducing the causes of site accidents to the barest minimum.

This study relates to the present study as it focused on examining the major causes of accidents and suggests ways of mitigating these accidents on construction sites. Both adopted descriptive survey research, both used questionnaire, both study used mean, standard deviation and ANOVA to analyzed the results. However, both studies differ in geographical area, number of research questions and hypotheses.

2.4 Summary of the Literature Reviewed

The Accident Root Causes Tracing Model (ARCTM), Swiss Cheese Model and Social Control Theories were extensively reviewed. ARCTM defined accident as 'an unplanned and uncontrolled event in which the action or reaction of an object, substance, person, or radiation results in personal injury or the probability thereof'. It was further revealed that accident can be prevented only if the chain of sequence is disturbed, for instance, the unsafe act/condition can be eliminated in order to prevent the accidents and associated injuries. The Swiss Cheese Model reviewed revealed that accidents can be caused either by singular human error or a combination of them as immediate causes of accidents; the combination of violation and mistake is a very usual cause of accidents. It was further revealed that, the equilibrium between the protection and the production is essential for the durable commercial survival of the business; since the production process is visible the product can be managed and inspected for the desired output but the level of protection can be measured only after the inadequacy is determined. The Social Control Theory reviewed revealed that individual's connection to and alienation with construction site or workplaces has a positive influence on risk perception. It was further revealed that, being able to participate in hazard identification and contribute to workplace safety improvement builds affiliation with an organization and leads to safer work practices.

The finding on empirical studies on safety in building construction site revealed that Safety is an economic as well as humanitarian concern that requires proper management control. Benefits of safety and health may include eliminating: injuries, property damage, down time, improvement in morale, enhance industrial relations, increased productivity, reduced cost and enhanced quality. The review on Causes of Accident in Construction Site and Control Measures revealed that, all accident, regardless of the nature of the damage or loss, should be of concern. It was further revealed that Safety and Accidents improvement measures and control systems in Building Construction Industry play a key role in eradicating accident at work. The study also reviewed Building Construction as a general term meaning, the art and science to form object, systems, or organizations which cover building construction.

Several empirical studies on researches conducted by scholars were reviewed. The studies that were reviewed indicated that safety in building construction site prevents accident to occur and also yields productivity. Because facilities can became worn out and fail, also human factors can result to non-utilization of safety facilities there is a need to provide evidence that determines the adequacy and utilization of safety facilities which is the gap that the present study intends to fill.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Research Design

A descriptive research design was adopted for the study. According to Uzoagulu (2011) a survey is a method of data collection using interviews or questionnaire to collect data from a sample that has been selected to represent a population to which the findings of the data analysis can be generalized. Ogundipe (2017) described descriptive survey research as a systematic means of data collection. This descriptive survey research design was considered suitable since the study is design to solicit information from the contractors, builders and tradesmen in Kaduna State, Nigeria for the purpose of generalization.

3.2 Area of the Study

The study was carried out in some selected building construction sites in FCT, Abuja and Niger State. FCT Abuja is situated in the North Central part of country. FCT Abuja is bordered by the state of Niger State to the west and Northwest, Kaduna to the Northeast, Nassarawa to the East and South, and Kogi to the Southwest. Niger State is situated in the North-Central Geopolitical Zone of Nigeria with a total land mass of 86,000km^2; approximately 8.6 million hectares constituting about 9.3% of the total land area of the country. Laying on latitude 3.20^0 east and longitude 11.30^0 North, the State shares a country border with the Republic of Benin West Federal Capital Territory (FCT) East, Kebbi, North-West, Kwara, South-West and Kaduna North West.

3.3 Population of the Study

The targeted population studied was 1020 respondents comprising of 20 contractors 400 builders and 600 tradesmen from 20 construction companies in FCT, Abuja and Niger State. (Table 3.1).

Table 3.1 Distribution of the Population in the Area of the Study

S/N	State	No of Contractors	No of Builders	No of Tradesmen
1	FCT, Abuja	17	346	537
2	Niger state	03	54	63
	Total	**20**	**400**	**600**

Sources: Zungeru Hydro-power plant, Niger State Ministry of Works and Niger state procurement board.

3.4 Sample and Sampling Technique

The sample of the study is 225 respondent. A proportional stratified random sampling was used to draw 10% of builders and tradesmen from FCT Abuja, while the entire population of builders and tradesmen in Niger State and the contractors in both FCT Abuja and Niger State were not sampled. Hence, the 10% builders and tradesmen from FCT Abuja and the remaining population were used for the study. (See table 3.2)

Table 3.2: Sampled Distribution for the Study Area.

S/N	State	No of Contractors	No of Builders	No of Tradesmen
1	FCT, Abuja	17	34	54
2	Niger state	3	54	63
	Total	**20**	**88**	**117**

Source: Zungeru Hydro-power plant, Niger State Ministry of Works and Niger state procurement board.

3.5 Instrument for Data Collection

The instrument used for data collection was a structured questionnaire titled: Building Construction Site Safety Facilities Questionnaire (BCSSFQ). The instrument was structured into two parts A and B. PART A consisted of personal data of the respondents. PART B was divided into four sections. Section one contained 24 items on adequacy of safety facilities in building construction sites. Section two contained 24 items on the extent of utilization of safety facilities in building construction sites,

section three contained 20 items on safety practices adopted in building construction sites, while Section four contained 20 items on the challenges encountered in the utilization of safety facilities. Various section of the research questions were structured on the four point rating scale measurement of Very Adequate (VA)=4, Adequate (A)=3,Moderately Adequate (MA)=2, and Not Adequate (NA) =1 for research question one. Very Often (VO)=4, Often (O) =3, Moderately Often (MO)=2, and Not Often (NO)= 1 for research question two, Highly Adopted (HA)=4,Adopted (A)=3, Moderately Adopted (MA)=2, and Not Adopted (NA) =1, for research question three, Strongly Agree (SA) =4,Agree A=3, Disagree (D)=2and Strongly Disagree (SD)=1 for research question four.

3.6 Validation of the Instrument

The Building Construction Site Safety Facilities Questionnaire (BCSSFQ) was validated by the three experts. One expert from the Department of Industrial and Technology Education, Federal University of Technology Minna, one expert Builder, and a Contractor from Dantata & Sawoe construction site in FCT Abuja, for face validation. The validity ascertained the suitability of the questions, their appropriateness, the scope, the content area and the language. Suggestions by the validates was used to produce the final draft of the BCSSFQ.

3.7 Reliability of the Instruments

A trial test was conducted on Building Construction Sites Safety Facilities Questionnaire using 23 randomly selected subjects comprising eight builders, five contractors and 10 tradesmen across various building construction sites in Nassarawa State. The choice of Nassarawa State for the trial testing exercise was informed by the fact that Nassarawa did not form part of the study area and also Nassarawa is in the same geopolitical zone with FCT Abuja and Niger State. In conducting the trial test, the

researcher used three research assistants that were trained on how to use the questionnaire to collect data.

Using split half method, the internal consistency of the instrument was computed using cronbach alpha reliability formula, which has been found to be more appropriate for reliability test of descriptive research. The internal consistency for the clusters were as follows; A = 0.89, B = 0.73, D = 0.76, E = 0.81 and The Overall reliability coefficient of the instrument was 0.80 indicating that the instrument had a high reliability; the items in the questionnaire were internally consistent in measuring what they are intended to measure for the study.

3.8 Method of Data Collection

The questionnaire was administered to the respondents by the researcher with the help of three research assistants. These research assistants were selected based on the training and familiarity with the study area. They were instructed by the researcher prior to the assignment on how to distribute and collect the copies of the questionnaire. They were further directed to request the contractors, builders and tradesmen to check (√) options of the questionnaire. The respondents who were able to complete the questionnaire on the spot were allowed to do so. Those who were not able to do so were allowed one week which the researcher collected the completed forms with help of the assistant researchers.

3.9 Method of Data Analysis

The data collected was organized and analyzed in-line with the research questions and hypotheses formulated for the study. Statistical Package for Social Science (SPSS version 23) was used for computation and analysis. Mean and Standard Deviations were

used to answer the research questions while analysis of variance (ANOVA) statistics was used to test the null hypotheses formulated for the study.

The decision on research questions were based on the resulting mean scores interpreted relative to the concept of real lower and upper limits of numbers: 3.50-4.00 (4); 2.50-3.49 (3); 1.50-2.49 (2) and 0.50-1.49 (1) respectively. Furthermore, the null hypotheses were tested using ANOVA at 0.05 level of significance. The decision on the null hypotheses formulated for the study was based on comparing the P value obtained with the significant value, where the P value is less than .05 ($P < .05$) hypothesis was rejected, while P is equal or greater than ($P \geq .05$) .05, the h ypothesis was upheld or accepted.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

The data collected for the study were analyzed and presented in this chapter. The analysis and presentation were organized based on research questions and hypotheses of the study.

4.1 Research Question 1

How adequate are the safety facilities in Building Construction Sites?

The data from answering research question is presented in table 4.1

Table 4.1: Mean and standard deviation of respondent on the adequacy of safety facilities in building construction sites. N = 181

S/N	Items	$\bar{x}$	SD	Remark
1	Safety helmet	3.17	0.84	A
2	Safety harness while working above 3m	1.67	0.51	MA
3	Protective clothing	3.60	0.66	VA
4	Safety goggles	2.59	0.75	A
5	Ear plugs	1.01	0.69	NA
6	cover of nose mask in dusty environment or aggregate works	3.90	0.67	VA
7	Bee net	2.96	0.65	A
8	Safety boots	1.14	0.77	NA
9	Head pans	3.24	0.78	A
10	Fire truck	1.96	0.75	MA
11	Safety cones	2.98	0.90	A
12	Speed reader	3.12	0.63	A
13	Safety panels	2.55	0.86	A
14	Safety basket for cranes	3.62	0.60	VA
15	Dust catchers for aggregate works	1.90	0.77	MA
16	Ammonia detecting device	1.01	0.63	NA
17	Oxygen detecting device	2.97	0.60	A
18	First aid box	3.13	0.73	A
19	Fire extinguishers	3.09	0.73	A
20	Fire blankets	2.95	0.81	A
21	Warning signs	3.00	0.85	A
22	Oxyacetylene cylinders	3.01	0.81	A
23	Constant supervision by expatriates	2.93	0.78	A
24	Safety gadgets	2.41	0.85	MA
	Mean/SD	**2.66**	**0.73**	

Key: N = Number of respondents; $\bar{x}$= mean; SD = Standard Deviation; VA= Very Adequate; A= Adequate; MA= Moderately Adequate; NA= Not Adequate.

Table 4.1 shows the mean responses of the respondents on twenty four (24) items posed to determine the adequacy of the safety facilities in building construction sites with grand mean of 2.66. The standard deviation of the items ranges from 0.51-0.90 which is

less than 1.96 meaning the respondents were not too far from the mean and were close to one another in their responses. This closeness of the respondents add value to the reliability of the mean. The result indicated that three items were very adequate, 14 were adequate, four moderately adequate while three were not adequate. This implied that most of the construction sites have adequate safety facilities

4.2 Research Question 2

What extent are the safety facilities utilized in building construction sites?

The data from answering research question is presented in table 4.2

Table 4.2: Mean and standard deviation of respondent on the extent of safety facilities utilized in Building Construction Sites. N = 181

S/N	Items	$\bar{x}$	SD	Remark
1	Safety helmet	3.62	0.82	VO
2	Use of Safety harness while working above 3m	1.67	0.50	MO
3	Protective clothing	1.80	0.64	MO
4	Safety goggles	2.59	0.73	O
5	Ear plugs	1.48	0.69	NO
6	Use of nose mask in dusty environment or aggregate works	3.88	0.67	VO
7	Bee net	2.96	0.65	O
8	Safety boots	1.14	0.77	NO
9	Head pans	2.24	0.78	MO
10	Fire truck	1.96	0.75	MO
11	Safety cones	2.98	0.87	O
12	Speed reader	3.12	0.63	O
13	Safety panels	1.45	0.86	NO
14	Safety basket for cranes	3.61	0.60	VO
15	Dust catchers for aggregate works	1.90	0.78	MO
16	Ammonia detecting device	1.01	0.63	NO
17	Oxygen detecting device	2.97	0.60	O
18	First aid box	3.13	0.73	O
19	Fire extinguishers	3.03	0.73	O
20	Fire blankets	2.95	0.81	O
21	Warning signs	3.01	0.58	O
22	Oxyacetylene cylinders	1.01	0.81	NO
23	Constant supervision by expatriates	3.47	0.88	O
24	Safety gadgets	1.49	0.75	MO
	Mean/SD	**2.44**	**0.71**	

Key: N = Number of respondents; $\bar{x}$= mean; SD = Standard Deviation; VO = Very Often; O= Often; MO= Moderately Often; NO= Not Often

Table 4.2 shows the mean responses of the respondents on twenty four (24) items posed to determine the extent of safety facilities utilized in building construction sites with grand mean of 2.44. The result indicated that three items were very often, 10 items were often, six moderately often while five were not often. The standard deviation of the items ranges from 0.50-0.88 which is less than 1.96 meaning the respondents were not too far from the mean and were close to one another in their responses. This closeness of the respondents adds value to the reliability of the mean. This means that safety facilities are not utilized in building construction sites.

4.3 Research Question 3

What are the safety practices adopted in building construction site in FCT, Abuja and Niger State?

The data from answering research question is presented in table 4.3

Table 4.3: Mean and standard deviation of respondent on the safety practices of respondents in building construction site. N = 181

S/N	Items	$\bar{x}$	SD	Remark
1	Safety orientation before site work	3.17	0.84	A
2	Wearing safety booth while working	1.67	0.51	MA
3	Safety clothes is always ensure	3.60	0.66	HA
4	Safety helmet is always available	2.59	0.75	A
5	There is always a caution sign in hazardous area	1.01	0.69	NA
6	Scaffolding is always on daily check before work	3.90	0.67	HA
7	Safety equipment acquisition and maintenance	2.96	0.65	A
8	Distribute pocket size copy of safety ethics to workers	1.14	0.77	NA
9	Adequate monitoring and inspection of workers	3.24	0.78	A
10	Working environment always cleared and kept free from all objects that can cause harm or injury to the workers	1.96	0.75	NA
11	Provision of safety booklet in various languages	2.98	0.90	A
12	Reward workers that exhibit excellent safety performance	3.12	0.63	A
13	Ladders fixed and adequately secured in positions before ascending them	2.55	0.86	A
14	Scaffoldings properly and adequately fixed and inspected before mounting them	3.62	0.60	HA
15	Daily consciousness of safety practices on site	1.90	0.77	MA
16	Allocate budget for safety management	1.01	0.63	NA
17	Workers obtaining safety clearance before start of work	2.97	0.60	MA
18	Training of the new staff on their related jobs and the use of tools and equipment	3.13	0.73	A
19	Provision of accidents prevention procedure and safety consciousness on site	3.09	0.73	A
20	Development and frequently review of safety policy for building production projects	2.95	0.81	A
	Mean/SD	**2.68**	**0.73**	

Key: N = Number of respondents; $\bar{x}$= mean; SD = Standard Deviation; HA = Highly Adopted; A= Adopted; MA= Moderately Adopted; NA= Not Adopted

Table 4.3 shows the mean responses of the respondents on 20 items posed to determine the safety practices adopted in building construction sites with grand mean of 2.68. The result indicated that three items were highly adopted, 10 were adopted, three moderately adopted, while four were not adopted The standard deviation of the items ranges from 0.50-0.88 which is less than 1.96 meaning the respondents were not too far from the mean and were close to one another in their responses. This closeness of the respondents adds value to the reliability of the mean. This implies that safety practices are adopted in building construction sites.

4.4 Research Question 4

What are the challenges on effective utilization of safety facilities in building construction site?

The data from answering research question is presented in table 4.4

Table 4.4: Mean and standard deviation of respondent on the challenges on the effective utilization of safety facilities in construction building site. N = 181

S/N	Items	$\bar{x}$	SD	Remark
1	Lack of safety helmet for all workers	3.13	0.67	A
2	Lack of job satisfaction	2.69	0.74	A
3	Improper supervision	3.14	0.64	A
4	Management attitude toward safety	3.15	0.71	A
5	Faulty construction technique	2.00	1.06	D
6	Improperly maintained and inadequate scaffolding	2.88	0.90	A
7	Lack of experience	3.04	0.83	A
8	Faulty construction techniques	3.78	0.53	SA
9	Noncompliance to standard safety rules and regulation	3.77	0.46	SA
10	Use of faulty tools	3.85	0.35	SA
11	Poor understanding of the risks associated with the work	3.73	0.54	SA
12	Over confidence	3.71	0.45	SA
13	Lack of safety training	3.71	0.59	SA
14	Influence of unsafe behaviour by workmates	3.60	0.58	SA
15	Shortages of equipment	3.70	0.55	SA
16	Carelessness	3.77	0.41	SA
17	Effect of alcohol shock	3.65	0.62	SA
18	Taking unsafe positions or postures	3.80	0.40	SA
19	Deliberate risk for bonus or speed	3.69	0.56	SA
20	Unsafe loading, arranging and placing	3.70	0.52	SA
Mean/SD		**3.42**	**0.60**	

Key: N = Number of respondents; $\bar{x}$= mean; SD = Standard Deviation; SA = Strongly Agree; A = Agree; D= Disagree

Table 4.4 shows the mean responses of the respondents on the twenty (20) items posed to determine the challenges on effective utilization of safety facilities in building construction site with a grand mean of 3.42.The result indicated that 13 items were strongly agree, six were agree, while one were disagree. The standard deviation of the items ranges from 0.35-1.06 which is less than 1.96 meaning the respondents were not too far from the mean and were close to one another in their responses. This closeness of the respondents adds value to the reliability of the mean. This implies that respondents agreed with the majority of items as challenges on effective utilization of safety facilities in building construction sites.

4.5 Hypothesis One

There is no significant difference in the mean responses of contractors, builders and tradesmen as regard the adequacies of safety facilities in building construction sites.

The result of the One-way ANOVA of mean scores of the respondents on the significant difference between the contractors, builders and tradesmen as regard the adequacies of safety facilities in building construction sites (table 4.5)showed p = .009. Levenes test of homogeneity of variance for the data was 0.354 (See Appendix H, Page 131, for homogeneity of variance) therefore, the assumption of homogeneity was met, since the value is greater than the significant level of (P< .05), therefore, ANOVA can be used for analysis.

Table 4.5: One way analysis of variance summary table showing the difference in the mean response of the contractors, builders and tradesmen as regard the adequacies of safety facilities in building construction sites.

	Sum of Squares	df	Mean Square	F	P	Remark
Between Groups	1534.810	2	767.405	4.860	.009	S
Within Groups	28104.273	178	157.889			
Total	29639.083	180				

(P<0.05) SD = Significant different

The result thus, revealed that there was significant differences (P<0.05) in the mean ratings of the respondents (contractors, builders and tradesmen) as regard the adequacies of safety facilities in building construction sites. These data supported the hypothesis, F (2, 178) = 4.860, p = .009. The mean and standard deviation for the contractors were 2.79 and 0.33; similarly, the mean and standard deviation for builders were 2.62 and 0.50, while the mean and standard deviation for tradesmen were 2.85 and 0.45 respectively. Hence, hypothesis one was rejected. This mean that there was significant difference in the mean scores of contractors, builders and tradesmen as regard the adequacies of safety facilities in building construction sites in FCT Abuja and Niger state. (Appendix H, Page 131, Post Hoc Turkeys HSD test) showed that there was statistical difference between the responses of builders and contractors p = 0.006; and tradesmen and contractors p = 0.006. However, there was no significant difference in the mean response of tradesmen and builders p= 0.859 as regard adequacies of safety facilities in building construction sites. This could be as a result of inadequacy of safety facilities in construction site in FCT Abuja and Niger State.

4.6 Hypothesis Two

There is no significant difference in the mean responses of contractors, builders and tradesmen as regard the extents of utilizing safety facilities in building construction sites.

The data for testing hypotheses two are presented in table 4.6.

Table 4.6: One way analysis of variance summary table showing the difference in the mean response of the contractors, builders and tradesmen as regard the extents of utilization of safety facilities in building construction sites.

	Sum of Squares	Df	Mean Square	F	P	Remark
Between Groups	389.725	2	194.862	1.576	0.210	NS
Within Groups	22014.386	178	123.676			
Total	22404.110	180				

(P>.05) NS = Not Significant

Table 4.6 revealed that there was no significant difference (P>0.05) in the mean ratings of the respondents (contractors, builders and tradesmen) as regard the extents of utilizing safety facilities in building construction sites. These data supported the hypothesis, F(2, 178) = 1.576, p = 0.210. The mean and standard deviation for contractors were 2.71 and 0.19; similarly, the mean and standard deviation for builders were 2.72 and 0.39 (See Appendix I, Page 132); while the mean and standard deviation for tradesmen were 2.81 and 0.31 respectively. Hence, hypothesis two was retained. This mean that there was no significant difference in the mean achievement scores of contractors, builders and tradesmen as regard the extents of utilizing safety facilities in building construction sites.

4.7 Hypothesis Three

There is no significant difference in the mean responses of contractors, builders and tradesmen on safety practices adopted in building construction sites.

The data for testing hypotheses two were presented in table 4.7.

Table 4.7: One way analysis of variance summary table showing the difference in the mean response of contractors, builders and tradesmen as regard the safety practices adopted in building construction sites

	Sum of Squares	Df	Mean Square	F	P	Remark
Between Groups	3166.722	2	1583.361	3.356	.370	NS
Within Groups	83970.759	178	471.746			
Total	87137.481	180				

(P>0.05) NS = Not Significant

Table 4.7 revealed that there was no significant difference (P>0.05) in the mean ratings of the respondents (contractors, builders and tradesmen) as regard the safety procedure practices in building construction sites. These data supported the hypothesis, F(2, 178) = 3.356, p = 0.370. The mean and standard deviation for contractors were 2.88 and 0.21. Similarly, the mean and standard deviation for builders were 2.82 and 0.43 (See Appendix K, Page 134). In addition, the mean and

standard deviation for tradesmen were 2.97 and 0.35 respectively. Hence, hypothesis three was retained. This mean that there was no significant difference in the mean achievement scores of contractors, builders and tradesmen as regard the safety procedure practices in building construction sites.

4.8 Hypothesis Four

There is no significant difference in the mean responses of contractors, builders and tradesmen on challenges on effective utilization of safety facilities in building construction sites.

The data for testing hypotheses two were presented in table 4.8

Table 4.8: One way analysis of variance summary table showing the difference in the mean response of the contractors, builders and tradesmen as regard the challenges on the effective utilization of safety facilities in building construction sites

	Sum of Squares	df	Mean Square	F	P	Remark
Between Groups	218.120	2	109.060	2.546	.812	NS
Within Groups	7624.609	178	42.835			
Total	7842.729	180				

(P>0.05) NS = Not Significant

Table 4.9 revealed that there was no significant difference (P>0.05) in the mean ratings of the respondents (contractors, builders and tradesmen) as regard the challenges on effective utilization of safety facilities in building construction sites. These data supported the hypothesis, F(2, 178) = 2.546, p = 0.812. The mean and standard deviation for contractors were 3.30 and 0.39. Similarly, the mean and standard deviation for builders were 3.44 and 0.31. In addition, the mean and standard deviation for tradesmen were 3.45 and 0.22 respectively. Hence, hypothesis four was retained. This mean, there was no significant difference in the mean achievement scores of contractors, builders and tradesmen as regard the challenges on effective utilization of safety facilities in building construction sites.

4.9 Findings of the Study

The following findings emerged from the study based on the research questions answered and the hypotheses tested.

1. The study revealed that 21 of the 24 items are utilized to a varying degrees. Three of the items, protective clothing, and nose mask in dusty environment or aggregate work, safety basket for cranes are found to be very adequately utilized; four items are moderately Adequate utilized; 14 items are adequately utilized, while three items are not adequately utilized. The results produced a grand mean of 2.66 for the entire items with a SD of 0.73
2. The study revealed that 19 of the 24 items are not utilized to a varying degree. Three of the items safety helmets, use of nose mask in a dusty environment or aggregate work, safety basket for cranes are found to be very often utilized; six items are moderately often utilized; 10 items are often utilized, while five items are not often utilized. The results produced a grand mean of 2.44 for the entire items with a SD of 0.71.
3. The study revealed that 17 of the 20 items are Adopted to a varying degrees. Three of the items safety cloth is always ensure, scaffolding is always on daily check before work, Ladders fixed and adequately secured in positions before ascending them, are found to be highly adopted; three items are moderately adopted; 10 items are adopted while four items are Not Adopted. The results produced a grand mean of 2.68 for the entire items with a SD of 0.73
4. The study revealed that 19 of the 20 items are effectively agreed to a varying degree. Six items agreed; 13 items are strongly agreed while one item disagrees. The results produced a grand mean of 3.42 for the entire items with a SD of 0.60.

5. It was found out that there is significant difference in the mean ratings of the contractors, builders and tradesmen as regard the adequacies of safety facilities in building construction sites. Using Post Hoc test, the null hypothesis of no significant difference was therefore rejected. It was also fund out that the builders/contractors, and tradesmen/contractors differ significantly in their opinions. However tradesmen/builders did not differ significantly in their opinions on the 24 items.
6. It was found out that there was no significant difference in the mean ratings of contractors, builders and tradesmen as regards the extents of utilizing safety facilities in building construction sites. The implication of this is that the contractors, builders and trades men did not differ significantly in their opinions on the 24 items.
7. It was found out that there was no significant difference in the mean ratings of the contractors, builders and tradesmen as regards the safety practices adopted in building construction sites.
8. It was found out that there was no significant difference in the mean ratings of the contractors, builders and tradesmen as regards the challenges on effective utilization of safety facilities in building construction sites.

4.10 Discussion of Findings

The major findings of the study were discussed in the order of the research questions and hypotheses formulated for study.

The finding on research question one revealed that the respondents agreed that three items were very adequate. However, three safety gadgets were not adequate in building construction site (ear plugs, safety boot, Ammonia detecting device). The findings of the study were in agreement with the findings of Adeagbo *et al.* (2019) that using of protective clothing, using of nose mask in dusty environment or during aggregate works

is adequate. The findings of Abdelhamid and Everett (2000), were also in conformity with the result of this study that, the use of safety helmet bee net as well as first aid box were adequate. However, the findings of (Agwu, 2012) were in disagreement with the findings of the study that, use of ear plugs, using of safety boots, fire truck and ammonia detecting device were not adequate in construction site.

The finding on research question two revealed that the respondents agreed that 10 items were often. However, five items were not often as regard the extent of safety facilities utilized in building construction sites (safety goggles, safety panels, safety boots). The findings of the study were in line to the findings of Agwu and Olele (2013) that making use of safety helmet and safety baskets for cranes were very often. Similarly, the findings of Ahmad *et al*. (2016) and Anon (2010) were also in conformity with the study which stated that, use of nose mask in dusty environment or aggregate works and Speed reader among others were often. However, Ahmad *et al*. (2016) further disagree with the findings of Charles *et al.* (2019) that making use of Oxyacetylene cylinders, using of Ammonia detecting device, safety boots as well as safety panels among others were not often in construction sites (Anyanwu, 2013).

The finding on research question three revealed that the respondents agreed that 10 items were adopted. However, four items were not adopted as safety practices in building construction site. The findings of the study were in conformity to the findings of Ibrahim *et al.* (2014) that scaffolding is always on daily check before work, scaffoldings properly and adequately fixed among others were highly adopted. Similarly, the findings of Idoro (2007) were also in conformity with the study that, adequate monitoring and inspection of workers, provision of safety booklet in various languages, safety orientation before site work among others were adopted. The author further supported the finding of Kadiri *et al.* (2014) that distributing pocket size copy of

safety ethics to workers, allocate budget for safety management among others were not adopted as supported by the author.

The finding on research question four revealed that the respondents agreed with 19 items. However, one item was disagreed by the respondents as regard to the challenges on the effective utilization of safety facilities in building construction sites. The findings of the study were in conformity to the findings of Kolo (2015) that poor understanding of the risks associated with work, noncompliance to standard safety rules and regulation, unsafe loading, arranging and placing among others were agree by the respondents. However, faulty construction technique was disagreeing by the respondent in building construction site as supported by Ogunbanjo (2010).

$H0_1$ -It was found out that there is significant difference in the mean ratings of the responses of the three groups of respondents (20 contractors, 71 builders and 90 tradesmen) as regard the adequacies of safety facilities in building construction sites. Using Post Hoc test, the null hypothesis of no significant difference was therefore rejected for the two groups (builders and contractors $p = 0.006$; tradesmen and contractors $p = 0.006$), but upheld (tradesmen and builders $p= 0.859$) on adequacies of safety facilities in building construction sites. The implication of this is that the builders/contractors, and tradesmen/contractors differs significantly in their opinions. However tradesmen/builders did not differs significantly in their opinions on the 24 items. Generally the findings of the study on hypothesis one were in line with the findings of Ogunbanjo, (2010) where it was found out that there is significance difference in the mean ratings of the responses of contractors, builders and tradesmen. The findings of Okolie & Okoye, (2012) gave credence to the findings of this study on hypothesis one as regards the adequacies of safety facilities in building construction sites.

$H0_2$ - It was found out that there was no significant difference in the mean ratings of the responses of the three groups of respondents (20 contractors, 71 builders and 90 tradesmen) as regards the extents of utilizing the safety facilities in building construction sites. The null hypothesis of no significant difference was therefore upheld for the three groups on extents of utilization of safety facilities. The implication of this is that the contractors, builders and trades men did not differ significantly in their opinions on the 24 items. Generally, the findings of the study on hypothesis two was in conformity with the findings of Paul, (2010) where it was found out that there is no significance difference in the mean ratings of the responses of contractors, builders and tradesmen. The findings of Prasad & Rao (2013) gave credence to the findings of this study on hypothesis two as regards the extents of utilizing the safety facilities in building construction sites.

$H0_3$ –It was found out that there was no significant difference in the mean ratings of the responses of the three groups of respondents (20 contractors, 71 builders and 90 tradesmen) as regards the safety practices adopted in building construction sites. The null hypothesis of no significant difference was therefore upheld for the three groups on safety practices adopted in building construction sites. The implication of this is that the contractors, builders and tradesmen did not differ significantly in their opinions on the 20 items. Generally, the findings of the study on hypothesis three was in conformity with the findings of Umeokafor (2014) where it was found out that there is no significance difference in the mean ratings of the responses of contractors, builders and tradesmen. The findings of Zaynab and Hijab (2012) gave credence to the findings of this study on hypothesis three as regards the safety practice adopted in building construction sites.

$H0_4$ - It was found out that there was no significant difference in the mean ratings of the responses of the three groups of respondents (20 contractors, 71 builders and 90 tradesmen) as regards the challenges on effective utilization of safety facilities in building construction sites. The null hypothesis of no significant difference was therefore upheld for the three groups on challenges of effective utilization of safety facilities. The implication of this is that the contractors, builders and trades men did not differ significantly in their opinions on the 20 items. Generally, the findings of the study on hypothesis four was in conformity with the findings of Selvam and Krithika (2019) where it was found out that there is no significance difference in the mean ratings of the responses of contractors, builders and tradesmen. The findings of Tambari (2018) gave credence to the findings of this study on hypothesis four as regards the challenges on effective utilization of safety facilities in building construction site.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Based on the findings and discussions of the study, the following conclusions were made; Contractors, builders and tradesmen collaborate agreed that safety facilities are not utilized in building construction site in FCT Abuja and Niger state. The implication of this is that, contractors, builders and tradesmen require appropriate training/induction on using the safety facilities base on their peculiarities.

Appropriate information concerning the applications, dissemination and diffusion of using personal protective equipment (PPE) at work, such as the use of safety protection, ammonia detecting device, safety boot and fire extinguishers are required in order to prevent accident on site.

5.2 Contribution to Knowledge

The study contributes to knowledge in the following areas;

1. The study provided information about the safety facilities needed on project site before work begin and ensuring safety during construction phase.
2. The study unveiled the need on organizing sensitization programs on causes of accidents such as safety education, safety drills rather than investigating accident.
3. The study also unveiled the need on improving training in accordance with the safety and health rules and regulations which apply to area of work.
4. The study illuminated the hidden truth concerning the utilization of safety facilities in building construction sites in FCT Abuja and Niger State Nigeria.
5. The study also contributed to the existing literature in the field of construction sites management and administration.

5.3 Recommendations

The following recommendations were made based on the findings of this study;

1. There should be strict enforcement of making available safety facilities in building construction by the construction site administrative in other to improve the safety of workers.
2. Contractors, builders and tradesmen require appropriate training /induction regularly on using the safety facilities in building construction site base on their peculiarities.
3. There should be appropriate safety education concerning the applications of using personal protective equipment (PPE) at work, such as the use of safety harness while working above 3m, ammonia detecting device, safety boot and fire extinguishers among others in order to prevent accident from site
4. Safety personnel should ensure the right safety practices is adopted in order to keep working environment cleared and free from all objects that can cause harm or injury to the workers in building construction sites. Recruitment should be based on technical know – how, since no tradesmen can work beyond skills/experience.

5.4 Suggestion for Further Studies

The following suggestions were made for further research;

Assessment of innovative safety training needs of building construction site in Central Nigeria.

1. The impact of safety equipment acquisition and maintenance in building construction site in Niger state and FCT Abuja.
2. Analysis of safety inclusion matters from the planning phase in building construction site in North Central Nigeria.
3. Effect of development and frequent review of safety policy for building construction site in North Central Nigeria.

REFERENCES

Abdelhamid, A. M., & Everett, J. G. (2000). Physiological demands during construction work. *Journal of Construction Engineering and Management.*128 (5) 1-15.

Adane, M. M., Gelaye, K. A., Beyera, G. K., Sharma, H. R., & Yalew, W. W. (2013). Occupational injuries among building construction workers in Gondar City, Ethiopia. *Occup Med Health Aff, 1*(125), 5.

Adeagbo, D.O., Dakar, A.I.I. & Izam, Y.D. (2019). Safety practices on building construction sites for sustainable development in Nigeria. *Journal of Sustainable Development in Africa,* 21 (4), 111-120

Adeniye, A. A. (2001). Health and safety on construction site. *Journal of Nigeria Institute of Building,* 10 (12), 873-876.

Adepoju, O., Aigbavboa, C., Nwulu, N., & Onyia, M. (2022). *Re-skilling human resources for construction 4.0*. Springer International Publishing.

Adewunmi, Y., Omirin, M., & Koleoso, H. (2012). Developing a sustainable approach to corporate FM in Nigeria. *Facilities*, *30*(9/10), 350-373.

Agwu, M. O. (2012). Total safety management: A strategy for improving organisational performance in chosen construction companies in Nigeria. *International Journal of Business and Social Science*, *3*(20).3 (20), 210–217.

Agwu, M. O., & Olele, H. E. (2013). Fatalities in the Nigeria country industry. A Case of Poor Safety Culture. *British journal of economics, management and trade* 4(3)

Agyekun, K., Simon, B., & Botchway, S. Y. (2018) Factors influencing the performance of safety management programme in the Ghanaian construction company. *Navorsingsartikels, Research articles,* 25(2), 39-61

Ahmad, U., Muhammad, Z. S., Ishfaq, A., & Masarrat, N. (2016). Occupational health and saety issues in the informal economic segment of Pakistan: A Survey of Construction Sites. *International Journal of Occupational Safety and Ergonomic.*24 (2), 240-250.

Ahmed, I., Shaukat, M. Z., Usman, A., Nawaz, M. M., & Nazir, M. S. (2018). Occupational health and safety issues in the informal economic segment of Pakistan: a survey of construction sites. *International journal of occupational safety and ergonomics*, *24*(2), 240-250.

Alfred, S., & Pao-Chi, C. (2019). Building construction. Construction Blog at Encyclopedia Retreived on May 18, 2019 . Britannica Incorporation. Https://Www.britannica.com/technology/buildingconstruction .

Ameachi, I. (1990). Accident on construction sites. *The Registered Building Journal.* 1 (2), 174-182.

Aniekwe, N. (2007). Accident and safety violations in the Nigeria construction industry. *Journal of Science and Technology (Ghana)*. 27 (1), 81-89.

Anon, M. (2010). Facilities for construction sites: Draft code of practice, Retrieved June 15th, 2017. https://submissions.swa.gov.au/SWAforms/*Facilities For Construction Sites.*

Anyanwu, C. I. (2013). The role of building construction project team members in building projects delivery. *IOSR Journal of Business and Management (IOSR-JBM)* Volume 14(1), 30-34.

Chapman, R. L., Buckley, L., Sheehan, M. C., & Schochet, I. M. (2013). School-based programs for increasing connectedness and reducing risk behavior: A Systematic Review. *Educational Psychology Review*.http://eprints.qut.edu.au/56849/.

Charles, I. A., Temidayo, O. O., & Clinton, O. A. (2019). Appraisal of the challenges to ensuring occupational health and safety compliance within the Nigerian construction industry. *Modular and Offsite Construction Summit*. 3(2), 2-9.

Chuks, O. K., & Uchenna, P. (2013). Appraising the influence of cultural determinants of contruction workers safety perception and behaviour in Nigeria. *International Journal of Engineering and Medical Science Research*, *1*(1), 11-24.

Construction Design & Management Regulations (CDMR) (2007). Provision of welfare facilities during construction work HSE information, Retrieved May 18, 2021 http://www.hse.gov.uk/construction..

Construction Design & Management Regulations (CDMR) (2015). Managing health and safety in construction.RetrievedJune16th,2021.http://www.hse.gov.uk/pubns/books/l153.htm

Dodo, M. (2014). The application of health and safety plan in Nigerian construction firms. *Jordan Journal of Civil Engineering.* 8, (1), 81-87. doi:10.14525/jjce.8.1.2631.

Dok Yen, D. M. I., Nana, T. K., & Adinyira, E. (2018). Assessing the Adequacy of welfare facilities on construction sites in Ghana. *Journal of Civil Engineering Research*, 8(3),70-75.

Ednana, E. (2020). Factors affecting the Performance of construction project in the gaze trip. *Journal of Civil Engineering and management.* 15 (3), 269-280.

Elufidipe, O. (2009). Prevention of accident on building construction sites. *International Journal of Insurance Policy. 2 (4), 10-15. ISSN: 2222-6990.*

Enshassi, A., Mohamed, S., Mustafa, Z. A., & Mayer, P. E. (2007). Factors affecting labour productivity in building projects in the Gaza Strip. *Journal of civil engineering and management*, *13*(4), 245-254.

Enshassi, A., Mohamed, S., Mustafa, Z. A., & Mayer, P. E. (2007). Factors affecting labour productivity in building projects in the Gaza Strip. *Journal of civil engineering and management*, *13*(4), 245-254.

Famakin, I., & Fawahinmi, W. (2012). Quality surveyors perception of construction health and safety regulation in Nigeria. *Journal of financial Management of Property and Construction*. 3 (1), 1-10.

Farhana, B. Z. (2014). Single factors theory of accident causation. Paper presentation at faculty of engineering & technology. ATBU

Farooqui, M., Kukoyi, P.O., & Smallwoo d, J. J. (2007). A qualitative study of health and Safety (H & S) construction practices in Lagos. *Journal of Construction Business and Management.*4 (2), 8.

Health and Safety Executive, (HSE) (2010). Successful health and safety management. London HMSO Books.

Heinrich, H. W., (1941) Industrial Accident Prevention. A Scientific Approach. Industrial Accident Prevention. A Scientific Approach.(Second Edition).

Hiba, J. C. (1998). Improving working conditions and productivity in the garment Industry, Geneva: International Lab our Office Publications.

Hirschi, T. (2015). Social Control Theory: A Control Theory of Delinquency. In *Criminology Theory* (pp. 289-305). Routledge.

Huang, X., & Hinze, J. (2006). Owner's role in construction safety. *Journal of construction engineering and management*, *132*(2), 164-173.

Ibrahim, I. I., Githae, W., & Stephen, D. (2014). Indigenous contractors involvement and performance in construction procurement systems in Nigeria. Global Journal of Researches in Engineering: *Journal of General Engineering.* 14 (1), 1-10

Idoro, G. I. (2007). Contractor's characteristics and health and safety performance in the Nigerian construction industry. *Journal of General Engineering;* 14 (1), 19-27.

Idoro, G. I. (2011). Effect of mechanisation on occupational health and safety performance in the Nigerian construction industry. *Journal of Construction in Developing countries, 16*(2), 27-45.

Idubor, E. E., & Oisamoje, M. D. (2013). An exploration of health and safety management issues in Nigeria's efforts to industrialize. *European Science Journal*, 9 (2), 154-169.

International Labour Office (2012), *Safety, Health and Welfare on Construction Sites,* Technical Report published by International Labour office Geneva.

International Labour Organisation (2017). Safety and health in construction; An ILO Code of Practice, Geneva: *International Labour Organisation Publications.*

Jimoh, R. A. (2012). Improving site management practices in the Nigerian construction industry: the builders' perspective. *Ethiopian Journal of Environmental Studies and Management*, *5*(4), 366-372.

John, R., Smith, A., Chotipanich, S., & Pitt, M. (2014). Awareness and effectiveness of quality function deployment (QFD) in design and build projects in Nigeria. *Journal of Facilities Management*, *12*(1), 72-88.

Kadiri, Z. O., Nden, T., Avre, G. K., Oladipo, T. O., Edom, A., Samuel, P. O., &Ananso, G. N. (2014). Causes and effects of accidents on construction sites (A Case Study of Some Selected Construction Firms in Abuja, FCT Nigeria). *Journal of Mechanical and Civil Engineering (IOSR-JMCE)*, e-ISSN:2278-1684, P-ISSN:2320-334x. 2 (5), 66-72.

Kolo, D. (2014). Safety Issues Involving Workers on Building Construction Sites in Nigeria: An Abuja Study. 1-22.

Kolo, N. D. (2015). Safety issues involving workers on building construction sites in Nigeria: An Abuja Study. Master Theses of Science in Civil Engineering Eastern Mediterranean University, Gazimağusa, North Cyprus.

Manase, D., Mahdjoubi, L. & Ahmed, V. (2019). Accident prevention on construction Sites: Towards a New Approach. School of Engineering and the Built Environment, University of Wolverhampton.

Mohammed, M. (2018). Appraisal of accident control measures in construction site in Niger State. *Journal of Occupational Health Psychology*, 16(1), 48-66.

Mosey, D. (2019). Collaborative construction procurement and improved value. print-ISBN: 9781119151913, online-ISBN:9781119151951, p. 1-17.

Muhammad, B. A., Abdulateef I., & Ladi, B. D. (2015). Assessment of cost impact in health and safety on construction projects. *American Journal of Engineering Research* (AJER); 4 (1), 25-30.

Myers, D. (2008). *Construction Economics.* Second Edition. London and New York: Taylor & Francis

Ogbu, C. P. (2011). Risk Management Practices of Multinational and Indigenous Construction Companies in Nigeria: A Comparative Analysis. *Journal of Research in National Development*, *9* (2), 315-324.

Ogunbanjo, A. (2010). An Overview of the Nigerian Oil and Gas Industry Content Development Act 2010.In Ogbu, C. P. (2011).Risk Management Practices of Multinational and indigenous Construction Companies in Nigeria: A comparative analysis.*Journal of research in national development*.*9*(2), 315-324.

Ogundipe, K. E. (2017). Safety Practices and Workers Performance on Construction Sites in Lagos State, Nigeria. Department of Building Technology, College of Science and Technology, Covenant University, Ota.

Okeola O. G (2009). Occupational Health and Safety (OHS) assessment in the construction industry. *1st annual civil engineering conference.* Physical Planning Unit, University of Ilorin, Nigeria.

Okolie, K. C., & Okoye, P. U. (2012). Assessment of National Culture Dimensions and Construction Health and Safety Climate in Nigeria. *Science Journal of Environmental Engineering Research*.12 (1), 1-6. doi: 10.7237/sjeer/167

Okoye, K., C., & Okoye, P. U. (2013). Appraising the Influence of Cultural Determinants of Construction Workers Safety Perception and Behavior in Nigeria.

Oladinrin, T. O., Ogunsemi, D. R., & Aje, I. O. (2012). Role of construction sector in economic growth: Empirical evidence from Nigeria. *FUTY Journal of the Environment*, *7*(1), 50-60.

Olelewe, C. J., & Amaka, E. N. (2011). Effective Utilization of Information and Communication Technology (ICT) for Sustainable Manpower Development Among Computer Educators in Colleges of Education in South East Geo-Political Zone of Nigeria. 3 (2), 66-70. DOI: 10-591/mjss.

Olowo-Okere, E. O. (1985). Construction Industry in Nigeria. *Journal for Building and Civil Engineering Construction in Nigeria.*2 (2), 6-10.

Osonwa, K. O., Eko, J. E., & Ozah, H. P. (2015). Utilization of Personal Protective Equipments (PPEs) Among Wood Factory Workers in Calabar Municipality, Southern Nigeria. *International Journal of Science and Research (IJSR).* 4 (5), 2-6.

Paul, R. (2010). Health and Safety on Construction Site in Ghana, Journal of Occupational and environmental Medicine, 43(10), 853-860,Jeong,B.Y. (2018). Occupational deaths and injuries in the Construction industry. Applied ergonomics, 29 (5), 355-360.

Prasad, K. S., & Rao, S.B.N. (2013). Occupational Accidents and injuiries in Construction Industry in Jeddah City.*Saudi Journal of Biological Science*, 27 (8), 193-198. https://doi.org/10.101/j. sjbs.

Rad, K. G. (2013). Application of domino theory to justify and prevent accident occurance in construction sites. *IOSR J. Mech. Civ. Eng. IOSR-JMCE*, *6*, 72-76.

Rao, B. P., Sreenivasan, A., & Babu, P. N. (2015). *Labour productivity*: Analysis and Ranking. *International Research Journal of Engineering and Technology* .2 (3), 29-37

Reason, J., Hollnagel, E., & Paries, J. (2006). Revisiting the Swiss cheese model of accidents. *Journal of Clinical Engineering*, *27*(4), 110-115.

Sanusi, A. (2008). General overview of Nigerian construction industry. *Published Masters Thesis from Massachusetts Institute of Technology, Department of Civil and Environmental Engineering*.

Sarah, P. (2012). *Health and Safet y Risk Management in Building Construction Sites in Tanzania:* The Practice of Risk Assessment, Communication and Control. Thesis for the Degree of Licentiate of Engineering. Department of Architecture, Chalmers University of Technology, Gothenburg Sweden.

Selvam, A., & Krithika, P. (2019). Safety Management and Hazards Control Measures in Construction. *IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)* 5(6) 24-29

Seyyed, S. H., & Zahra, J. T. (2012). Major Theories of Construction Accident Causation Models: A Literature Review. *International Journal of Advances in Engineering & Technology*, 53(4), 53-66.

Siriwardena, N. U., Haigh, R. P., & Ingirige, M. J. B. (2006). Disaster in search of definition: Specific Construction Industry. *Journal of Research Institute for the built environment.* University of Salsford U.K. 3(8), 249-257

Suresh, G., & Vijayarani, K. (2015). Intra-mural and Extra-mural Welfare Facilities. *International Journal of World Research,* 1(20) 13-23.

Tambari, D. (2018). Utilization of information communication and technology for sustainable manpower development among technical educators in tertiary institutions in River State, Nigeria. *International Journal of Innovation Information Systems & Technology Research,* 4(3).11-23.

Uduakobonge, E. U., Edidiong, E. U., & Christian, F. A. (2016). Effect of lack of adequate attention to safety measures on construction sites in Akwa-Ibom State, Nigeria. *Journal of Earth Sciences and Geotechnical Engineering*, 6(1), 2016, 113-121.

Umeokafor, N., Isaac, D., Jones, K., &Umeadi, B. (2014). Enforcement of occupational safety and health regulations in Nigeria: An exploration. *European Scientific Journal (ESJ)*. 10 (7), 1-6. https/doi.org/10.19044/esj.

Uzoagulu, A. E. (2011). Practical Guide to Writing Research Project Report in Tertiary Institutions. Enugu. *John Jacobs Classic Publishers Ltd.*

Wahab, K. A. (1991). Satisfying the training needs of management and staff in the construction industry: cited in Fagbenle, O. I., Ogunde, A. O., & Owolabi, J. D. (2011). Factors affecting the performance of Labour in Nigerian construction sites. *Mediterranean Journal of Social Sciences, 2*(2) 141-157.

Winder, C., & Makin, A. M (2006). Do self-assessment tools assist the effectiveness of performance bases of legislation? *Journal of occupational Health and Safety*.18 (3), 1338.

Zaynab, A. B., & Hijab, M. (2012). Safety culture of Nigerian construction workers-a case study of Yola. *International Journal of Scientific and Engineering Research*, 3(2), 132-145.

Zhang, M., Shi, R., & Yang, Z. (2020). A critical review of vision-based occupational health and safety monitoring of construction site workers. *Safety science*, *126*, 104658.

APPENDIX A

Questionnaire on Adequacy and Utilization of Safety Facilities in Building Construction Sites in FCT Abuja and Niger State, Nigeria.

Section A: Personal Data

Please complete the questionnaire by ticking (√) on the option that best justifies your view by writing your opinion on use of safety facilities and adequacy of safety facilities in Building construction site.

Please, complete the information below as are applicable to you.

Status: Tradesmen ( )

Contractor ( )

Builder ( )

This section request for your opinion on the items using the scales provided below for each item. The four columns refers to the level of safety procedure and accident prevention method adopted in Building construction Site in FCT Abuja and Niger State, Nigeria.

SECTION B

Research Question One (1): How adequate are the safety facilities in Building Construction Sites?

Very Adequate (VA)=4 Adequate (A) =3

Moderately Adequate (MA)=2 Not Adequate (NA)=1

S/N	ITEM STATEMENT	VA	A	MA	NA
1	Safety helmet				
2	Use of Safety harness while working above 3m				
3	Protective clothing				
4	Safety goggles				
5	Ear plugs				
6	Use of nose mask in dusty environment or aggregate works				
7	Bee net				
8	Safety boots				
9	Head pans				
10	Fire truck				
11	Safety cones				
12	Speed reader				
13	Safety panels				
14	Safety basket for cranes				
15	Dust catchers for aggregate works				
16	Ammonia detecting device				
17	Oxygen detecting device				
18	First aid box				
19	Fire extinguishers				
20	Fire blankets				
21	Warning signs				
22	Oxyacetylene cylinders				
23	Constant supervision by expatriates				
24	Safety gadgets				

SECTION C

Research Question Two (2): To what extent are the utilization of safety facilities in Building Construction Sites?

Very Often (VO)=4 Often (A)=3

Rarely Often (RO)=2 Not Often (NO)=1

S/N	ITEM STATEMENT	VO	O	RO	NO
1	Safety helmet				
2	Use of Safety harness while working above 3m				
3	Protective clothing				
4	Safety goggles				
5	Ear plugs				
6	Use of nose mask in dusty environment or aggregate works				
7	Bee net				
8	Safety boots				
9	Head pans				
10	Fire truck				
11	Safety cones				
12	Speed reader				
13	Safety panels				
14	Safety basket for cranes				
15	Dust catchers for aggregate works				
16	Ammonia detecting device				
17	Oxygen detecting device				
18	First aid box				
19	Fire extinguishers				
20	Fire blankets				
21	Warning signs				
22	Oxyacetylene cylinders				
23	Constant supervision by expatriates				
24	Safety gadgets				

SECTION D

Research Question 3: What are the safety practices adopted in building construction site?

Highly Adopted (HA)=4 Adopted (A)=3

Moderately Adopted (MD)=2 Not Adopted (NA)=1

S/N	ITEM STATEMENT	HA	A	MA	NA
1	Safety orientation before site work				
2	Wearing safety booth while working				
3	Safety clothes is always ensure				
4	Safety helmet is always available				

5	There is always a caution sign in hazardous area				
6	Scaffolding is always on daily check before work				
7	Safety equipment acquisition and maintenance				
8	Distribute pocket size copy of safety ethics to workers				
9	Adequate monitoring and inspection of workers				
10	Working environment always cleared and kept free from all objects that can cause harm or injury to the workers				
11	Provision of safety booklet in various languages				
12	Reward workers that exhibit excellent safety performance				
13	Ladders fixed and adequately secured in positions before ascending them				
14	Scaffoldings properly and adequately fixed and inspected before mounting them				
15	Daily consciousness of safety practices on site				
16	Allocate budget for safety management				
17	Workers obtaining safety clearance before start of work				
18	Training of the new staff on their related jobs and the use of tools and equipment				
19	Provision of accidents prevention procedure and safety consciousness on site				
20	Development and frequently review of safety policy for building production projects				

SECTION E

Research Question 4: What are the challenges on the effective utilization of safety facilities in building construction site?

Strongly Agree (SA)=4 Agree (A)=3 Disagree (D)=2 Strongly Disagree (NA)=1

S/N	ITEM STATEMENT	SA	A	D	SD
1	Lack of safety helmet for all workers				
2	Lack of job satisfaction				
3	Improper supervision				
4	Management attitude toward safety				
5	Faulty construction technique				
6	Improperly maintained and inadequate scaffolding				
7	Lack of experience				
8	Faulty construction techniques				
9	Noncompliance to standard safety rules and				

	regulation				
10	Use of faulty tools				
11	Poor understanding of the risks associated with the work				
12	Over confidence				
13	Lack of safety training				
14	Influence of unsafe behaviour by workmates				
15	Shortages of equipment				
16	Carelessness				
17	Effect of alcohol shock				
18	taking unsafe positions or postures				
19	Deliberate risk for bonus or speed				
20	Unsafe loading, arranging and placing				

APPENDIX B

How adequate are the safety facilities in Building Construction Sites?

```
DESCRIPTIVES VARIABLES=B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B14 B15
B16 B17 B18 B19 B20 B21 B22 B23 B24
  /STATISTICS=MEAN STDDEV RANGE.
```

Descriptive Statistics

	N	Range	Mean	Std. Deviation
Safety helmet	181	3.00	3.1768	.84440
Use of Safety harness while working above 3m	181	2.00	1.6796	.51324
Protective clothing	181	3.00	3.6077	.66311
Safety goggles	181	3.00	2.5912	.75919
Ear plugs	181	3.00	1.0166	.69502
Use of nose mask in dusty environment or aggregate works	181	3.00	3.9061	.67249
Bee net	181	3.00	2.9613	.65290
Safety boots	181	3.00	1.1492	.77090
Head pans	181	3.00	3.2486	.78815
Fire truck	181	3.00	1.9613	.75546
Safety cones	181	3.00	2.9834	.90967
Speed reader	181	2.00	3.1215	.63825
Safety panels	181	3.00	2.5525	.86523
Safety basket for cranes	181	2.00	3.6243	.60760
Dust catchers for aggregate works	181	3.00	1.9061	.77245
Ammonia detecting device	181	3.00	1.0166	.63662
Oxygen detecting device	181	2.00	2.9724	.60029
First aid box	181	3.00	3.1381	.73616
Fire extinguishers	181	3.00	3.0939	.73562
Fire blankets	181	3.00	2.9503	.81156
Warning signs	181	3.00	3.0055	.85957
Oxyacetylene cylinders	181	3.00	3.0166	.81292
Constant supervision by expatriates	181	3.00	2.9337	.78600
Safety gadgets	181	3.00	2.9171	.85556
Valid N (listwise)	181			

APPENDIX C

To what extent are the utilization of safety facilities in Building Construction Sites?

```
DESCRIPTIVES VARIABLES=C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15
C16 C17 C18 C19 C20 C21 C22 C23 C24
  /STATISTICS=MEAN STDDEV VARIANCE.
```

Descriptive Statistics

	N	Mean	Std. Deviation	Variance
Safety helmet	181	3.6233	0.82234	.591
Use of Safety harness while working above 3m	181	1.6745	0.50563	.618
Protective clothing	181	1.8065	0.64765	.500
Safety goggles	181	2.5976	0.73453	.233
Ear plugs	181	1.4809	0.69365	.212
Use of nose mask in dusty environment or aggregate works	181	3.8809	0.67374	.435
Bee net	181	2.9680	0.65686	.380
Safety boots	181	1.148	0.77658	.396
Head pans	181	2.24004	0.78443	.194
Fire truck	181	1.9056	0.75214	.595
Safety cones	181	2.9801	0.87365	.467
Speed reader	181	3.1202	0.63879	.908
Safety panels	181	1.4545	0.86098	.529
Safety basket for cranes	181	3.6167	0.60709	.507
Dust catchers for aggregate works	181	1.9043	0.78860	.654
Ammonia detecting device	181	1.0118	0.63093	.820
Oxygen detecting device	181	2.9774	0.60205	.471
Fire extinguishers	181	3.1338	0.73103	.435
Fire blankets	181	3.0343	0.73003	.651
Warning signs	181	2.9585	0.81201	.673
Oxyacetylene cylinders	181	3.0138	0.58398	1.113
Constant supervision by expatriates	181	1.0179	0.81234	.841
Safety gadgets	181	3.4723	0.88097	1.082
Valid N (listwise)	181	68		

APPENDIX D

What are the safety practices adopted in building construction site?

```
DESCRIPTIVES VARIABLES=D1 D2 D3 D4 D5 D6 D7 D8 D9 D10 D11 D12 D13
D14 D15 D16 D17 D18 D19 D20
  /STATISTICS=MEAN STDDEV RANGE.
```

Descriptive Statistics

	N	Range	Mean	Std. Deviation
Safety orientation before site work	181	3.00	3.1735	.84234
Wearing safety booth while working	181	2.00	1.6708	.51213
Safety clothes is always ensure	181	2.00	3.6009	.66678
Safety helmet is always available	181	2.00	2.5970	.75345
There is always a caution sign in hazardous area	181	3.00	1.0154	.69012
Scaffolding is always on daily check before work	181	3.00	3.9090	.67679
Safety equipment acquisition and maintenance	181	3.00	2.9610	.65049
Distribute pocket size copy of safety ethics to workers	181	2.00	1.1490	.77910
Adequate monitoring and inspection of workers	181	2.00	3.2400	.78076
Working environment always cleared and kept free from all objects that can cause harm or injury to the workers	181	2.00	1.9687	.75093
Provision of safety booklet in various languages	181	1.00	2.9854	.90095
Reward workers that exhibit excellent safety performance	181	2.00	3.1287	.63097
Ladders fixed and adequately secured in positions before ascending them	181	1.00	2.5512	.86032
Scaffoldings properly and adequately fixed and inspected before mounting them	181	2.00	3.6209	.60068
Daily consciousness of safety practices on site	181	2.00	1.9040	.77012
Allocate budget for safety management	181	2.00	1.0123	.63094
Workers obtaining safety clearance before start of work	181	1.00	2.9740	.60009
Training of the new staff on their related jobs and the use of tools and equipment	181	3.00	3.1330	.73098
Provision of accidents prevention procedure and safety consciousness on site	181	1.00	3.0924	.73879
Development and frequently review of safety policy for building production projects	181	2.00	2.9510	.81657
Valid N (listwise)	181			

APPENDIX E

What are the challenges on the effective utilization of safety facilities in construction building site?

```
DESCRIPTIVES VARIABLES=E1 E2 E3 E4 E5 E6 E7 E8 E9 E10 E11 E12 E13 E14
E15 E16 E17 E18 E19 E20
  /STATISTICS=MEAN STDDEV RANGE.
```

Descriptive Statistics

	N	Range	Mean	Std. Deviation
Lack of safety helmet for all workers	181	3.00	3.1334	0.67386
Lack of job satisfaction	181	2.00	2.6956	0.74185
Improper supervision	181	3.00	3.1478	0.64076
Management attitude toward safety	181	3.00	3.1565	0.71932
Faulty construction technique	181	3.00	2.0009	1.06574
Improperly maintained and inadequate scaffolding	181	3.00	2.8809	0.90036
Lack of experience	181	3.00	3.0470	0.83915
Faulty construction techniques	181	3.00	3.7880	0.53754
Noncompliance to standard safety rules and regulation	181	3.00	3.7705	0.46035
Use of faulty tools	181	3.00	3.8503	0.35037
Poor understanding of the risks associated with the work	181	3.00	3.7370	0.54365
Over confidence	181	2.00	3.7130	0.45016
Lack of safety training	181	3.00	3.7198	0.59275
Influence of unsafe behaviour by workmates	181	2.00	3.6045	0.58698
Shortages of equipment	181	3.00	3.7067	0.55037
Carelessness	181	3.00	3.7742	0.41025
Effect of alcohol shock	181	2.00	3.6517	0.62164
taking unsafe positions or postures	181	3.00	3.8068	0.40580
Deliberate risk for bonus or speed	181	3.00	3.6932	0.56023
Unsafe loading, arranging and placing	181	3.00	3.7023	0.52143065
Valid N (listwise)	181			

APPENDIX F

Data analysis on hypotheses one

ONEWAY How adequate is the safety facilities in Building Construction Sites BY number of respondents
/STATISTICS DESCRIPTIVES EFFECTS HOMOGENEITY BROWNFORSYTHE
/MISSING ANALYSIS
/POSTHOC=TUKEY BTUKEY ALPHA (0.05). Oneway

Descriptives

How adequate are the safety facilities in Building Construction Sites

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	Between-Component Variance
						Lower Bound	Upper Bound			
Tradesmen		90	2.85677	0.45578	1.29719	74.5558	79.7108	39.00	93.00	
Builders		71	2.62806	0.50575	1.62060	67.7256	74.1899	39.00	93.00	
Contractors		20	2.79629	0.33699	2.03457	71.2416	79.7584	61.00	93.00	
Total		181	2.76038	0.47526	.95380	72.6483	76.4125	39.00	93.00	
Model	Fixed Effects			12.56540	.93398	72.6873	76.3735			
	Random Effects				2.37008	64.3327	84.7280			11.47995

Test of Homogeneity of Variances

How adequate are the safety facilities in Building Construction Sites

Levene Statistic	df1	df2	Sig.
1.043	2	178	.354

ANOVA

How adequate are the safety facilities in Building Construction Sites

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1534.810	2	767.405	4.860	.009
Within Groups	28104.273	178	157.889		
Total	29639.083	180			

Post Hoc Tests

Multiple Comparisons

Dependent Variable: How adequate are the safety facilities in Building Construction Sites

	(I) numberofrespondents	(J) numberofrespondents	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	Tradesmen	Builders	6.17559*	1.99452	.006	1.4616	10.8896
		Contractors	1.63333	3.10625	.859	-5.7082	8.9749
	Builders	Tradesmen	-6.17559*	1.99452	.006	-10.8896	-1.4616
		Contractors	-4.54225	3.18092	.329	-12.0603	2.9758
	Contractors	Tradesmen	-1.63333	3.10625	.859	-8.9749	5.7082
		Builders	4.54225	3.18092	.329	-2.9758	12.0603

*. The mean difference is significant at the 0.05 level.

APPENDIX G

Data analysis on hypotheses two

```
ONEWAY To what extent are the safety facilities utilized BY number of respondents
  /STATISTICS DESCRIPTIVES EFFECTS HOMOGENEITY BROWNFORSYTHE
  /MISSING ANALYSIS
  /POSTHOC=TUKEY BTUKEY ALPHA (0.05).
```

Descriptives

To what extent are the safety facilities utilized

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	Between-Component Variance
						Lower Bound	Upper Bound			
Tradesmen		90	2.81212	0.310137	1.07882	90.6564	94.9436	53.00	116.00	
Builders		71	2.72684	0.395152	1.54757	86.8994	93.0724	53.00	116.00	
Contractors		20	2.71212	0.195275	1.44094	86.4841	92.5159	78.00	101.00	
Total		181	2.76762	0.338075	.82926	89.6952	92.9678	53.00	116.00	
Model	Fixed Effects			11.12099	.82662	89.7003	92.9627			
	Random Effects				1.11241	86.5452	96.1178			1.34076

Test of Homogeneity of Variances

To what extent are the safety facilities utilized

Levene Statistic	df1	df2	Sig.
3.253	2	178	.041

ANOVA

To what extent are the safety facilities utilized

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	389.725	2	194.862	1.576	.210
Within Groups	22014.386	178	123.676		
Total	22404.110	180			

Robust Tests of Equality of Means

To what extent are the safety facilities utilized

	Statistic[a]	df1	df2	Sig.
Brown-Forsythe	2.020	2	145.681	.136

a. Asymptotically F distributed.

Homogeneous Subsets

To what extent are the safety facilities utilized

			Subset for alpha = 0.05
	Numberofrespondents	N	1
TukeyHSD[a,b]	Contractors	20	89.5000
	Builders	71	89.9859
	Tradesmen	90	92.8000
	Sig.		.383
TukeyB[a,b]	Contractors	20	89.5000
	Builders	71	89.9859
	Tradesmen	90	92.8000

APPENDIX H

Data analysis on hypotheses three

```
ONE WAY What are the safety practices adopted  BY number of respondents
  /STATISTICS DESCRIPTIVES EFFECTS HOMOGENEITY WELCH
  /MISSING ANALYSIS
  /POSTHOC=TUKEY BTUKEY ALPHA(0.05).
```

Descriptives

How functional is the state of safety facilities

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	Between-Component Variance
						Lower Bound	Upper Bound			
Tradesmen		90	3.45895	0.22635	.54877	78.4652	80.6460	60.00	92.00	
Builders		71	3.44580	0.31220	.85220	77.5539	80.9532	57.00	92.00	
Contractors		20	3.30217	0.39935	2.05385	71.6512	80.2488	57.00	92.00	
Total		181	3.30217	0.28699	.49063	78.0705	80.0068	57.00	92.00	
Model	Fixed Effects			6.54484	.48647	78.0787	79.9987			
	Random Effects				.86730	75.3070	82.7704			1.24732

Test of Homogeneity of Variances

What are the safety practices adopted in construction sites

Levene Statistic	df1	df2	Sig.
6.233	2	178	.002

ANOVA

What are the safety practices adopted in construction sites

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	218.120	2	109.060	2.546	.812
Within Groups	7624.609	178	42.835		
Total	7842.729	180			

Robust Tests of Equality of Means

What are the safety practices adopted in construction sites

	Statistic[a]	df1	df2	Sig.
Welch	1.420	2	47.345	.252

a. Asymptotically F distributed.

Homogeneous Subsets

What are the safety practices adopted in construction sites

			Subset for alpha = 0.05	
	Numberofrespondents	N	1	2
TukeyHSD[a,b]	Contractors	20	75.9500	
	Builders	71	79.2535	79.2535
	Tradesmen	90		79.5556
	Sig.		.065	.977
TukeyB[a,b]	Contractors	20	75.9500	
	Builders	71		79.2535
	Tradesmen	90		79.5556

APPENDIX I

Data analysis on hypotheses four

```
ONEWAY What are the challenges on effective utilization BY numberofrespondents
  /STATISTICS DESCRIPTIVES EFFECTS HOMOGENEITY WELCH
  /MISSING ANALYSIS
  /POSTHOC=TUKEY BTUKEY ALPHA(0.05).
```

Descriptives

How often is the safety procedure practices

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	Between-Component Variance
						Lower Bound	Upper Bound			
Tradesmen		90	2.978736	0.351723	2.15034	168.4940	177.0394	95.00	212.00	
Builders		71	2.8254	0.432253	2.97535	157.9391	169.8074	95.00	212.00	
Contractors		20	2.889655	0.214281	2.77906	161.7834	173.4166	141.00	183.00	
Total		181	2.908744	0.379348	1.63541	165.4801	171.9342	95.00	212.00	
Model	Fixed Effects			21.71971	1.61441	165.5213	171.8930			
	Random Effects				3.35560	154.2692	183.1452			20.93676

Test of Homogeneity of Variances

What are the challenges on effective utilization

Levene Statistic	df1	df2	Sig.
2.862	2	178	.060

ANOVA

What are the challenges on effective utilization of safety facilities

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3166.722	2	1583.361	3.356	.370
Within Groups	83970.759	178	471.746		
Total	87137.481	180			

Robust Tests of Equality of Means

How often is the safety procedure practices

	Statistic[a]	df1	df2	Sig.
Welch	3.112	2	69.504	.051

a. Asymptotically F distributed.

Homogeneous Subsets

What are the challenges on effective utilization

			Subset for alpha = 0.05
	Numberofrespondents	N	1
TukeyHSD[a,b]	Builders	71	163.8732
	Contractors	20	167.6000
	Tradesmen	90	172.7667
	Sig.		.163
TukeyB[a,b]	Builders	71	163.8732
	Contractors	20	167.6000
	Tradesmen	90	172.7667