ANALYSIS OF FACTORS INFLUENCING EFFECTIVE SAFETY PROGRAMME IMPLEMENTATION IN PIPELINE CONSTRUCTION PROJECTS IN PORT-HARCOURT, RIVER STATE

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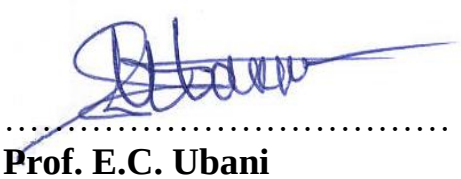
CERTIFICATION

This is to certify that this study **ANALYSIS OF FACTORS INFLUENCING EFFECTIVE SAFETY PROGRAMME IMPLEMENTATION IN PIPELINE CONSTRUCTION PROJECTS IN PORT-HARCOURT, RIVERS STATE** written by **Nneamaka Chioma Mbachu** (**20184139868**) was formally approved for the award of Master of Sciences in Project Management Technology, Federal University of Technology Owerri.



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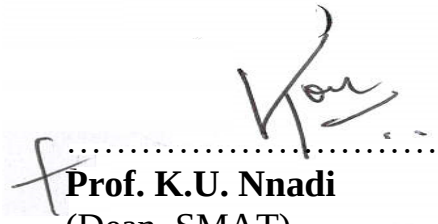

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DEDICATION

This work is dedicated to Almighty God who in his infinite mercy protected, guided, directed and inspired me throughout these years of my academic pursuit in this great citadel of learning and during the compilation of this project work, may his name alone be praised.

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TABLE OF CONTENTS

LIST OF TABLES

ABSTRACT

This study examined the success factors influencing safety Programme implementation in pipeline construction project in Nigeria using Greenocean Pipeline Services Limited, Port Harcourt, Rivers State as a case study. A structured questionnaire was used to collect the data concerning success factors influencing safety Programme implementation, and data analysis was done using Statistical Package for the Social Sciences (SPSS) version 21. The target population of the study was 112 respondents. Tables and simple percentage were used to present the data collected. Kaiser-Mayer-Olkin (KMO) and Bartlett's Test was employed to test the research hypotheses. Relative importance index (RII) was used to rank the factors influencing accident causation. From the study, carelessness and negligence were ranked first with a RII value of 0.93. The estimation of the possible factors that affect safety Programme implementation on pipeline Construction is done using the Critical Factor Analysis technique (CFA), Motivation and Appropriate supervision are positively correlated to the principal component 1 (PC1), It was therefore concluded that each of the factors has indicated a high potential of improving Safety Programme implementation on pipeline Construction projects in Port Harcourt, River State. Successful safety programme implementation would need an effective enforcement plan, motivation of workers, appropriate supervision, safety training, and education.

KEYWORDS: Success factors, Safety programme implementation, Critical Factor Analysis, Principal Component Analysis, Misjudgement of hazardous situation, organisational commitment, Accident Causation, Relative Importance Index.

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Construction industry plays a fundamental role in increasing the economy of many countries. It provides the infrastructure required for other parts of the economy to grow, thus reflecting the level of economic development of the countries (Abas, Suhaini, Kariya, Mohammad, & Hasmori., 2020). Greenocean Pipeline Services Limited has earned reputation for quality and outstanding innovation in pipeline construction that is second to none. Greenocean Pipeline team has personnel with wealth of experience in the delivery of pipeline design, engineering, procurement, construction, installation, and commissioning.

Construction is an important sector that provides necessary infrastructure and facilities, which contribute to the wellbeing of society (Islam, Nazifa, Priyanka, Ahmed & Shahid, 2019). Strong linkages exist between the construction sector and other sectors, which, by and large, have proven to be the impetus for the growing influence of the construction sector in the economic development around the world (Abdelhakim, Jones, Redmond, Hewedi, & Seaman, 2019). The importance of the sector is proven by its rapid growth in recent years, a growth which experts expect to continue, despite the impact of the COVID-19 pandemic. The construction

industry is also a large employer of labor, thereby promoting economic and social development.

Unfortunately, despite its significance, the industry has poor safety performance (Zakaria, Hussin, Noordin, 2018). Early statistics revealed that about 7% of workers worldwide were engaged in the construction industry, but they represent 30–40% of fatalities across industrial sectors (Awwad, El Souki and Jabbour, 2016).

Globally, pipeline construction is one of the most hazardous industry sectors with many thousands of workers being killed and seriously injured each year. Worldwide occupational injury rates in pipeline construction as highest for all major industries (Abdelhakim, Jones, Redmond, Hewedi, & Seaman, 2019). Pipeline construction is always risky because of outdoor operations, work-at height, complicated on-site plant machinery and equipment operation coupled with worker's attitudes and behaviours towards safety (El Touny, Ibrahim, and Mohamed, 2021).

The unique characteristics of the construction industry, such as being labour intensive, dynamics, and exposed to weather conditions, also contribute to the poor safety performance of the industry (Boustras, Hadjimanolis, Economides, Yiannaki and Nicolaides, 2017). In such a hazardous work environment, safety Programme is a proactive method to promote safety on construction sites (Tonmoy, Shakil, and Md Shahed,2018). Top management has a very important role to play in implementing this safety Programme because they are the ones who

allocate resources to ensure the success of the Programme (Boateng, 2019). The implementation of an effective safety Programme can eventually lead to the development of positive safety culture (Celik Carraro, Eboli, Farnia, Parrado, and Pierfederici, 2018). The aim of this research is to examine the success factors affecting safety Programme implementation in pipeline construction project in Nigeria. A comprehensive literature review was conducted to identify these factors, while semi structured interviews were used with construction industry practitioners to verify the critical success factors.

1.2 Problem Statement

Most construction organizations have basic requirements that employers must meet as regards the organization of health and safety activities (Hasle & Limborg, (2005). Organizations are normally required to establish a management system, which should include a health and safety committee, election of safety representatives and periodical risk assessment (Hasle & Limborg (2005). Recent fire outbreaks in most construction company have led to scrutiny on the level of preparedness and conformance to health and safety measures taken by employers for both the employees and the customers (Maze, 2009). According to Mbakaya, Onyoyo, Lwaki & Omondi (2000), a baseline survey conducted on management perspectives of the state of workplace health and safety practices in Kenya, results from 65 participants indicated that most workplace managers were not familiar with the legislation.

Although most respondents (70%) were satisfied with their work safety conditions, only 37% said their workplaces were annually audited by labour inspectors while 45% said injuries workers were not treated well by management. Many workplaces 65% violated the mandatory legal requirements on the establishment of health and safety committees. The Occupational health and safety (OHS), resource person and course content were rated highly by respondents (96%). The foregoing results provided the basis of a need analysis for future occupational health and safety (OHS) Programmes. According to Dessler (2008), while employees have a responsibility to comply with occupational safety and health act (OSHA) standards, they often resist, the employer usually remains liable for any penalties. The refusal of some workers to wear hard hats as mandated by OSHA requirements typifies this problem. Employees have attempted to defend themselves against penalties for such non-compliance by citing worker intransigence and their own fear of wildcat strikes and walkouts. Employee commitment to safety and health Programmes is a major challenge. Many organizations face the problem of employees ignoring and even being hostile to safety and health measures. The reason is that employees often view safety and health measures as intrusive and inefficient (Balkin, Cardy & Mejia (2007).

Despite studies being done on the importance of health and safety measures such as Mbakaya, Onyoyo, Lwaki, & Omondi (2000), and Maze (2009) none has focused

on the factors affecting the safety Programme implementation. This study aims at filling the knowledge gap by analysing factors affecting effective safety Programme implementation in pipeline projects in Port Harcourt, rivers state.

1.3 Objectives of the study

The main objective of this study is to analyse factors affecting effective safety Programme implementation in pipeline projects in Port Harcourt, Rivers state. The specific Objectives were to:

i. Identify the performance indicators in safety management practice on pipeline construction projects.
ii. Identify and prioritize the factors that influence accident causation on pipeline construction projects.
iii. Examine the success factors for effective safety Programme implementation in pipeline construction projects to aid in decision-making process, and better safety management in Port Harcourt, Rivers State.

1.4 Research Questions

1. What are the performance indicators in safety management practice on pipeline construction projects in Nigeria?
2. What are the factors that influence accident causation on pipeline construction?

3. What are the factors that influence effective safety Programme implementation in pipeline construction projects in Nigeria?

1.5 Research hypotheses

$H0_1$: Performance indicators in safety management practice do not significantly have effect on pipeline construction projects.

$H0_2$: The factors that influence accident causation on pipeline construction projects in Nigeria cannot be identified and prioritised.

$H0_3$: The identified factors influencing effective safety Programme implementation has no significant effect on successful pipeline construction projects.

1.6 Justification for the study

This research will therefore be of great benefit to parties responsible for ensuring the implementation of internationally acceptable standards of health and safety on construction sites in Nigeria, such as the government, clients, consultants, contractors, workers, and civil society.

The results of the study will be beneficial to construction firms and practising professionals who are interested in designing safety training Programmes that translate to improved safety performance in construction firms. The findings of this study can significantly advance theory and practise in the areas of construction safety and health and safety training design and delivery.

It will also provide further suggestions and solutions to construction stakeholders on measures to upgrade safety practices on construction projects. This research may also serve as a reliable material source for policymakers when drafting appropriate regulations and enforceable laws to be applied at pipeline construction sites, especially the promised bill to be presented in parliament setting the standards for construction. It was expected to contribute to the knowledge of future readers and serve as a source of reference for further research.

1.7 Scope of the study

This study focuses on the factors affecting effective safety Programme implementation in pipeline projects in Port Harcourt, rivers state. For the purpose of this study, the variables to be examined are the current state of safety Programme implementation, factors that influence accident causation, and factors for effective safety Programme implementation. The geographical scope of the study was the Just concluded project in March, 2023 by Greenocean Pipeline Services Limited, Port Harcourt, Rivers State titled ‘Construction, Repair and Maintenance of 12-iches, 18 Kilometres on-shore Gas pipeline, spanning Abiama-Obuzor-Owaza communities for SPDC. Accident-Causing Theory, which is the theory related to safety precautions, will essentially be concerned with the pipeline construction project. This study would basically concentrate on industries with a workforce

capacity of not less than 100 people, therefore, this study was on one company only (case study).

CHAPTER TWO

LITERATURE REVIEW

2.1 Conceptual Review

2.1.1 Project Critical Success Factors

Researchers have advanced that identifying and managing the project success/failure critical factors is crucial if the development agenda of the organization is to be realized. UNDP (2002).

A project manager should learn how to juggle with the different reasons why projects fail or succeed in order to ensure the situations are enhanced before they worsen. The critical factors include human related factors, project-management related factors and factors related to the external environment (Chan, 2004). Research has indicated that few studies have focused on project management and they have narrowed down to critical success factors which influence the safety Programme implementation in pipeline construction project (Buniya*et al*., 2021).

2.1.2 Safety

Occupational safety and health is an area concerned with the development, promotion, and maintenance of the workplace environment, policies and Programmes that ensure the mental, physical, and emotional well-being of employees, as well as keeping the workplace environment relatively free from actual or potential hazards that could injure employees (Campagnolo *et al*., 2021).

Occupational safety and health is a discipline dealing with the prevention work related injuries and diseases and the protection and promotion of the health of worker it aim at the improvement of working condition and environment. Occupational safety and health (OSH) in construction is generally defined as the science of the anticipation, recognition, evaluation and control of hazards arising in or from the workplace that could impair the health and well-being of workers, taking into account the possible impact on the surrounding communities and the general environment. Safety Defined as the fact of being free from danger or risk or to take safety precaution or safety measures to make sure something safe (Dictionary of human resource and personnel management 2003). According to (Cao *et al*., 2017) safety defined as the condition of being protected against any type of events (accidents) which could be considered non-desirable by controlling hazards to achieve an acceptable level of risk. Also, accident defined as some sudden and unexpected event taking place without expectation that causes injury, damages or death (Cao *et al*., 2017).

Anton (1989) defined a construction safety Programme as ‘‘the control of the working environment, equipment, processes, and the workers for the purpose of reducing accidental injuries and losses in the workplace.

2.1.3 Causes of Construction Accidents

Due to the high number of accidents that occur in construction and the consequences of it for workers, organizations, society and countries, occupational safety has become a very important issue for stakeholders to take care of the human resource. Causes of accidents can be attributed to factors such as human error, unsafe behavior, and the interaction of humans with materials, tools, and environmental factors (Milind *et al*., 2017). Most of the accidents are caused by human error. The human error is considered as an undesirable human decision or action that reduces the effectiveness of safety or system performance. Examples are misuse of equipment and tools and misconduct of workers (Milind *et al*., 2017). Construction-project features, such as the project nature, method of construction, site restriction, project duration, procurement system, design complexity, level of construction, and subcontracting, contribute to accidents, and that the features' contribution is through the introduction of proximal accident causal factors in the construction process (Milind *et al*., 2017).

There are three basic causes of work place accidents;¬Chance of occurrence

Unsafe condition and Unsafe acts

2.1.3.1 Unsafe Condition

Unsafe Conditions are the mechanical and physical conditions that cause accidents. These are main causes of accidents and include things like:

Improper guarded areas, inappropriate personal protective equipment's, Hazardous procedure in, on or around machines or equipment's, improper illumination glare, insufficient light in working night shifts. We can reduce unsafe conditions by Engineering control, Administrative or Organizational Controls and using personal protective equipment's (Department of Occupational Safety and Health, 2021).

2.1.3.2 Unsafe Acts

Unsafe acts can even the best attempts to reduce unsafe conditions but they are not easy answers to the question of what cause people to act recklessly. We can reduce unsafe acts by emphasize in top management commitment, emphasize on safety, establishing a safety policy, reduce unsafe acts through selection, providing safety training, using posters and other propaganda, using positive reinforcement, using behavior based safety Programmes, encouraging worker participation and by conducting safety inspections regularly (Department of Occupational Safety and Health, 2021).

2.1.4 Safety Measures in Construction

2.1.4.1 Site Layout and Planning

A badly planned and untidy site is the underlying cause of many accidents. This results from falls of material and collisions between workers and plant or equipment. Space constraints, particularly in urban work sites, are nearly always the biggest limiting factor and a layout which caters best for the safety and health of workers

may appear to be difficult to reconcile with productivity. Proper planning by management is an essential part of preparation and budgeting for the safe and efficient running of a construction operation. There are many accidents due to tripping, slipping or falling over materials and equipment which have been left lying around, and stepping on nails which have been left projecting from timber (Department of Occupational Safety and Health, 2021).

2.1.4.2 Personal Protective Equipment (PPE)

Personal protective equipment (PPE) refers to protective clothing, helmets, goggles, or other garment or equipment designed to protect the wearer's body from injury by blunt impacts, electrical hazards, heat, chemicals, and infection, for job-related occupational health and safety purposes. OSHA (2007) requires the use of personal protective equipment (PPE) to reduce employee exposure to hazards when engineering and administrative controls are not feasible or effective in reducing these exposures to acceptable levels. If PPE is to be used, a PPE Programme should be implemented. This Programme should address the hazards present; the selection, maintenance, and use of PPE; the training of employees; and monitoring of the Programme to ensure its ongoing effectiveness. The PPE required in the construction sites include; eye protection and face protection, hearing protection, respiratory protection, hand and arm protection, foot and leg protection, head protection and body and fall protection mechanisms During this survey it was observed that

construction workers on the sites lacked appropriate protective equipment for instance workers were noted carrying out high risk activities such as painting, excavations, concreting among others without the right protective gear such as helmets, masks, ear muffs, goggles and overalls (Kang, 2016).

2.1.4.3 First aid Kits and Accident Reporting

Construction sites are dangerous places, and first aid and rescue equipment should always be available. What is needed depends on the size of the site and the numbers employed, but there should be a blanket and a stretcher. On large sites with more than 200 people are employed, there should be a properly equipped first aid room (El Touny *et al*., 2021). On any construction site of that size, at least one person on every shift should have been trained in first aid to a nationally recognized standard. On day -to-day works procedures, an accident register book should be kept at the site, in which all types of minor injury such as bruises, to major accidents like imputing disability and fatal should be recorded. This survey established that the construction sites that had first aid boxes were ill equipped with only spirit, bandage and cotton wool. Again the requirement that at least one person on every shift should be trained in first aid to a nationally recognized standard was not met since no respondent indicated having been trained as a first aider. First aid is a life saving exercise which is taken for granted on the sites visited and shows that workers are exposed to danger and risks when injured. Considering that accidents are rampant in

construction sites as respondents indicated having witnessed some sort of accident first aid facilities is necessary (El Touny*et al*., 2021).

2.1.4.4Safety Warning Signs

Safety Signs and Signals are one of the main means of communicating safety information. This includes the use of illuminated signs, hand and acoustic signals (e.g. fire alarms), spoken communication and the marking of pipe work containing dangerous substances. Traditional signboards, such as prohibition and warning signs, signs for fire exits, fire action plan notices (fire drills) and fire-fighting equipment are also considered to be Safety Signs. It is critical that all Safety Signs and Signals can be easily understood. Where signboards are used in a workplace they should be sufficiently large and clear so that they can be easily seen and understood. Signboards also need to be durable, securely fastened and properly maintained to ensure they remain visible. Care must be taken to avoid using too many signboards in close proximity, signboards are only effective if they can be seen and understood. If too many signs are placed together there is a danger of confusion or of important information being over looked (Eleni, 2018).

2.1.4.5 Safety Policy

Site managers should have a written safety policy for their enterprise setting out the safety and health standards which it is their objective to achieve. 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 they are carried out (Guo, 2017). Construction safety policy therefore is something that must be developed by each site manager and operating company prior to starting any construction job. Once developed the development safety plan should be placed into a training Programme that's needed to be participated in by every site worker previous to partaking in any job found on the positioning irrespective of the roles simplicity. The absence of site meetings as established in this survey implies that workers are not given a forum learn about various risks on the sites and supervisors equally do not have opportunities to communicate important safety matters to the workers. Site meetings are one of the ways of sensitizing workers on their safety in the site and should therefore be held frequently (Guo, 2017).

2.1.4.6 Working Environment

According to ILO (1999), chemical Substances are a major health hazards since there are many chemicals used in the construction industry, which include insecticides, adhesives, cleaning agents, wood preservatives, fungicides, and paints among others. Many of these chemicals are hazardous, with a potential to cause poisoning. Toxic substances can cause both acute and chronic effects resulting from exposure for a long period. Dusts from many sources are also a prominent hazard in construction. Silica and asbestos dust can permanently damage the lung tissue,

whilst lead in dust is absorbed into lungs and enters the blood stream causing poisoning. Cement mixes is also a well-known cause of skin disease. Lead is found in electricity cables, pipes gutters and lead sheet roofs. Excessive lead absorption causes constipation, abdominal pain, anaemia, weak muscles and kidney failure (Guo, 2017).

2.1.4.7 Welfare Facilities

Work in the construction industry is tough and involves much manual or physical activity. It is also hazardous and dirty and therefore good welfare facilities not only improve workers' welfare but also enhance efficiency. Welfare facilities such as the provision of drinking-water, washing, sanitary and changing accommodation, restrooms and shelter, facilities for preparing and eating meals, temporary housing, assistance in transport from place of residence to the work site and back, all help to reduce fatigue and improve workers' health |(ICSU, 2017).

2.1.5 Current State of Construction Safety Practices and Performance

Safety can be viewed as a point at which all associated risks with a particular job are well managed in a reasonable manner (Izatul*et al*., 2016). Weick (1991); Brueggman (2001) and Ahmad, Iqbal, Rashid, Iqbal and Roomi (2016) defined safety as unique event that is paramount to continuous attainment of productivity. In the same vein, Ahmad, Iqbal, Rashid, Iqbal and Roomi (2016) opined that safety focus on curbing accidents at work setting and its negative effect on the workers in

all manner. Assessment of various researchers such as: Aniekwu (2007); Idoro 2011; Okolie and Okoye (2012); Idubor and Oisamoje (2013); Dodo (2014); and Umeokafor *et al.*, (2014); on provisions and management of safety in construction project reveals that adoption and compliance with safety provision served as catalyst in optimizing construction production process. On the other hand, without compliance to safety practices, more accident will result in pains, accidents and legal actions thereby escalating production cost.

Based on this, Famakin &Fawehinmi (2012) stated that 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.

The anomalies as seen in the construction firm's failure to comply with minimum requirement of safety practices might cause the victim waste of time and 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 tectonic 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 (Keivan*et al*., 2020). Thus, the lack of adherence to safety practices will delay the production process of construction activities.

Several attempts have been considered by the construction industry towards improving its safety performance. However, the paradigm shifts from monitoring safety performance to preventive measures of improving safety performance. Ikechukwu, and Dorothy (2013) and Muhammad, Abdulateef and Ladi (2015) stated that some of the developing nations like Nigeria among the developing nations that lacks adaptive laws and regulations on safety practices. The study added that, effective management of safety practices are aided by various factors such as: socio-humanitarian perspective, and financial-economic perspective. Khalid*et al*., (2021) added that construction company should provide awareness particularly on each project that covers an outline of the project, a top to bottom survey of the safety necessities and desires, clearing arrangements and systems, disciplinary activities, substance manhandle testing policy and proactive management methods needed for the project.

A nationwide survey was conducted by Boustras, Hadjimanolis, Economides, Yiannaki and Nicolaides (2015) on management of health and safety of micro-firms in Cyprus. The study looked at the determinant factors of safety performance at the work environment in small scale firms. The study was purposive in nature; therefore, copies of structured questionnaire were used to gather data needed. Going by the outcome of the study, work settings safety in small scale firms can be improved by embracing "training", "risk assessment,' and "safety policy

formulation." The research findings showed that, the nature and characteristic of management systems demonstrated in an organisation, methods designed for attaining work objectives, and resources available have significant influence on small scale firm. The study contradicts some previous research outcome on the ground that adoption of "quality management system" cannot be said to have significance collaboration with safety outcome in the final model.

Awwad, El Souki and Jabbour (2016) examined construction safety practices and challenges in a Middle Eastern developing country. Face to face survey was conducted using structured questionnaire with the construction practitioners, insurance firms and government agencies. The findings of the study however showed the availability of construction labour safety law but lack necessary implementation, absence of monitoring, failure of safety awareness and inadequate support from the entire participant concerned with implementations of safety practices on construction sites. This study called for appropriate awareness within the construction firms' which might be of helpful in curbing these challenges.

Kolawole (2014) assessed safety measures on pipeline sites: a case study of Minna, North Central Nigeria. The study examined safety approach adopted in Minna construction firms, it also evaluates if implementation of safety regulation will reduce workers' claim for accident on sites or motivate them for better performance. Population needed for the study was randomly selected among pipeline construction

firms through copies of structured questionnaire. Result from the analysis noted that site workers embraced “safety training” as this enhances their performances and reduced accidents on site and also government did not have well defined safety act for construction activities. The study recommended training and re-training of their workers on the relevance of safety practices, while government should develop and enact “safety act” for controlling site based injury.

Idoro (2011) studied effect of mechanization on Occupational Health and Safety (OHS) performance of the Nigerian construction industry. This study evaluated the level of mechanisation and its relationship to the Occupational Health and Safety (OHS) performance in the industry and also established impact of mechanisation on OHS performance and implored the commitment of contractors to effective OHS management. Questionnaire was adopted and analysed by percentages, means, *t*-tests and Spearman’s correlation tests. The results of the study indicated that increase in mechanisation also increased the rates of accident and injury occurrences. This study concluded that failure to effectively manage mechanisation worsen OHS performance on project sites. However, construction managers should devise means of effective measures that will implement control of OHS performance before using new or additional safety wears.

Agwu (2012) conducted a study on total safety management (TSM) an approach for improving organisational performance in selected construction firms in Nigeria.

The study adopted stratified and random sampling technique for the copies of questionnaire distributed among the selected six most famous construction firms operating in Nigeria, they include:(Julius Berger Nigeria Plc, Setraco Nigeria Ltd, Fourgerolle Nigeria Ltd, Arab-Contractors Nigeria Ltd, Dantata & Sawoe Nigeria Ltd and Costain Nigeria Ltd). The outcome of the research suggested that integration of total safety management as part of the organisational policy would lead to improving safety practices on construction projects. The study therefore recommended that, to sustain the advantage of total safety practices in Nigerian, operatives need to maintain good attitudinal behavior and structural modifications in management of construction safety. Babu (2015) study aimed at investigating safety performance on the construction sites. The study soughed the opinion of construction participant using copies of structured questionnaire to appraised safety performances on their construction sites. The outcome revealed inadequate support from the government, insurance companies, ministry of labour, and construction participant.

Okoye, Ezeokonkwo, and Ezeokoli (2016) studied pipeline construction workers 'safety knowledge and compliance on sites in Anambra State, Nigeria. The research employed Mean Score Index and Pearson's Product-moment Correlation Coefficient (**r**) to analyze the data randomly sampled from the fifteen (15) selected construction sites in the study area. However, the outcome of the research showed

that, low safety awareness and compliance among the sites operatives, this resort into low project performance. The study recommended that, knowledge and compliance with safety practices alone cannot achieve optimum project performance, it would require safety culture which encompassed other factors are as follows: management commitment, workers involvement and strict enforcement of safety regulation should be adopted. In view of this, Akinwale and Olusanya (2016) studied implications of occupational health and safety intelligence in Nigeria via cross-sectional research design and risk society and sense-making theories'. The study conducted 15 in-depth interviews ranges from the managers and senior staffer of the selected organizations in Lagos State, Nigeria. Data were subjected to content analysis and ethnographic technique. However, the study affirmed that managers and employees are the major target of occupational health hazards, such as loss of man-hours, productivity, and job security. High level of awareness on the importance of occupational safety was recorded but inadequate investment in the capacity building on safety' Programmes in the organisation. The study therefore recommends good policy on occupational health with adequate investment in precautions and safety intelligence will enhance individual and organizational development in Nigeria.

2.1.6 Construction Safety Regulations

Kiani*et al* (2018) define construction regulations as statutory instruments setting out the minimum legal requirements for construction works and relate primarily to the health, safety and welfare of the workforce which must be taken into account when planning construction operations and during the actual construction period. Regulation cannot on its own be effective without enforcement.

The Federal Ministry of Labour and employment is saddled with the responsibility of enforcing the Factories Act and Employee's Compensation Act, while the Labour, Safety, Health and Welfare Bill of 2012 empowers the National Council for Occupational Safety and Health of Nigeria to administer the proceeding regulations on its behalf. In the developed countries such as UK, USA, Australia, Singapore and Germany, these regulations are well developed and functional. However, despite being among the countries that signed the occupational health and safety law in the Geneva Convention of 1981, the pathetic safety situation in Nigeria construction industry still pervades.

In spite of numerous statutory provisions and expectations in Nigeria, gap still exist in health and safety management (Skibniewski *et al*, 2016). This gap is largely due to a dysfunctional safety law, causing an apparent lack of regulation of health and safety in almost every sector of the economy. Adeogun and Okafor (2013) contend

that these acts are not being enforced in Nigeria as evidenced from the reports of unhealthy exposure to risks of workers and employees in various organisations.

According to Olawumi*et al*, 2019, the Ministry charged with enforcement of these laws has not been effective in identifying violators probably due to inadequate funding, lack of basic resources and training therefore, consequently neglect safety oversight of other enterprises, particularly construction sites and non factory works. Umeokafor, Isaac, Jones and Umeadi (2014) agree that the impact of the enforcement authority is ineffective, as the key stakeholders pay less attention to OSH regulations; thus, rendering the OSH scheme dysfunctional and unenforceable, at the same time impeding OSH development.

Kolo (2015) further observes that some provisions from these laws do not necessarily meet the conditions experienced in Nigeria. In addition, the labour law does not provide workers with right to remove themselves from dangerous work situations without loss of employment. Nevertheless, the emergence of new regulations, laws, standards and codes has made many construction organisations to improve their safety performance.

2.1.7 Safety in Nigerian Construction Industry

Nigeria, being the most populous country in Africa and also the largest economy in Africa (World Bank, 2016), its construction industry plays an important role in the

nation's economy. In 2012 the sector's contribution to national gross domestic product stood at 3.05% and in that same year the sector employed circa 6.9 million workers (National Bureau of Statistics, 2015). In spite of the socio-economic significance of the construction sector, it has an enviable reputation in terms of occupational health and safety. Accident and injury rates in developing countries like Nigeria are generally considered to be higher than in the developed countries (Lobo*et al*., 2015). This has been attributed to a lack of appropriate consideration of H&S management measures or practices in construction project delivery process (Othman*et al*, 2018). Despite being a party to the Geneva Occupational Safety and Health Convention 1981, Nigeria continues to lag behind in the implementation occupational H&S practices (Adeogun and Okafor, 2013). According to Idoro (2011) contractors with the best safety records in Nigeria still record substantially high numbers of injuries on their sites. A survey of 42 Nigerian contractors revealed such poor performance with rates such as 5 injuries per worker and 2 accidents per 100 workers even among some of the best performing firms (Idoro, 2011). According to Ezenwa (2001) these figures are often even worse in practice as a result of a culture of under-reporting and concealment. Other studies have further highlighted a high prevalence ofnon-compliance with safety regulations that require organisations to report accidents (Pierobon, 2019).

2.1.8 Common Accidents on Construction Sites

Accidents according to Aniekwu (2007) are unplanned and unexpected events, which result from mistake somewhere, somehow and by somebody. The causes of accidents on construction sites are a subject of many studies across the world (Radek*et al*., 2018). Laryea and Mensah (2022) categorised construction related accidents causing factors as those at the Macro level consisting of factors such as lack of enforcement, lack of accident data; Mezzo; consisting of factors including inappropriate procurement and supply chain arrangements and Micro level factors such as inadequate competent supervisors, lack of training of personnel among others. Aniekwu (2007) identified major accident causing factors as use of faulty tools and equipments, non compliance with standards, improper scaffolding, and lack of experience and improper storage of dangerous and flammable substances. The eccentric problems causing accidents on construction sites in Nigeria are improper keeping of records, non reporting of accidents by employees, unsafe practices by contractors and lack of safety management as a whole on the side of the clients (Olutuase, 2014).

2.1.9 Current factors that influence safety practices on pipeline construction sites

2.1.9.1 Safety Awareness

Before any worker — no matter his or her role or experience level — can set foot on a construction site, he or she must be fully aware of the possible hazards. Ignorant workers are perhaps the biggest dangers in any industry, as their unknowing mistakes put everyone else at risk. Understanding of perils at hand and sustaining a perpetual state of alertness is perhaps the number-one best way to prevent accidents. Every single person that steps foot onto a construction site should be aware of the risks associated with the job and how to prevent them with their knowledge of construction site safety (Retchless*et al*., 2016).

2.1.9.2 Training

Though most of a construction worker's skills can be gained on the job, safety is one skill set that is best learned before works enter the construction site. The Occupational Safety and Health Administration (OSHA) and other organizations publish some resources to help businesses train their new laborers on standard safety and security practices, including pamphlets, worksheets, training videos, and even on-site training opportunities. Experienced workers should be expected to refresh their knowledge of standard safety by attending regular training sessions throughout the year (Hale *et al*., 2010). These training sessions can go over simple things such

as fall protection and proper use of ladders, but the goal is to make sure everyone is adequately trained. Leaving these training sessions, workers should know what safety measure to do in the case of an incident (Hale *et al*., 2010).

2.1.9.3 Communication

Accidents are more likely to occur when workers are unsure what to expect. Direct discussion of the day's goals and activities will cut down on surprises that could cause bodily harm. Construction firms would be wise to equip workers with devices, like smartphones, walkie-talkies, or headsets, which allow fast and efficient communication among team members. Without proper communication between everyone on the construction site, workers won't know what to expect. Clear and concise communication with everyone not only makes the project go by faster but also helps keep each person informed. Informing the staff and making sure everyone is doing their job is a proper way to communicate and make sure they understand construction site safety (Wamuziri, 2006).

2.1.9.4 Documentation

To enforce construction site safety, proper documentation of everything that is going to be done on-site has to be in place. There are some legal hoops most construction companies must jump through to begin building, and it is essential that all proper registrations and licenses are earned before work begins. Supervisors and contractors who will be charged with particularly difficult tasks, like blasting, certainly should

provide evidence of their certification well in advance of their employment on the job site. Not only does this prevent accidents due to improper training, but it protects the construction firm from legal action and public scrutiny. Any safety hazards that make their way to the media will look bad for construction firms (Dı´az-Cabrera *et al*., 2007).

2.1.9.5 Proper Equipment and machine capacity

To create a culture centered on construction site safety, you need to give workers the proper equipment and adequate work area for the job at hand. Without the proper equipment, you can't have construction site safety because there will always be an opportunity to get injured using the wrong equipment. Construction workers equipped with improper gear are bound to make fatal errors. Not only should each piece of equipment on the job site be ideally suited to the task at hand, but construction firms have to make sure that all machinery and material are well maintained (Dı´az-Cabrera *et al*., 2007).

2.1.9.6 Supervision

Ideally, construction workers would fully understand the ramifications of inadequate safety precautions and thus act in a manner to ensure site-wide well-being — but this is not a perfect world. Every site must have a strong supervisor who is willing and capable of enforcing safety standards with no exceptions. This foreman must

keep tabs on all employees throughout the day and correct those who fail to commit to proper construction site safety procedures (Dı´az-Cabrera *et al*., 2007).

2.1.9.7 Innovation

The accident rate would be even higher than it is today if it wasn't for construction firms willing to devote extra resources to keep their employees safe. These additional resources not only lower the rates of workplace accidents and injuries but also help develop new ideas for keeping construction workers safe. The development of new practices that will enhance security should always be encouraged, and companies should avoid speaking against legislation aimed at improving safety protocols. Perhaps with enough innovation, all construction sites can maximize their construction site safety practices and can be 100 percent accident-free (Hamed *et al*., 2017).

2.1.9.8 Transparency

The worst thing any construction firm can do for its reputation is attempting a cover-up. Hiding accidents from the press and the public not only lowers the opinion of a single endeavor — it paints the pipeline industry as a whole in a negative light. Ultimately, people understand that accidents happen, and as long as contractors are doing their best to foster a safe environment for their workers, any accidents that do occur will only contribute to the growing need to augment modern safety techniques. Transparency, along with the other seven practices on this list, will help construction

as a whole become a safer industry in which to work. A safer construction industry is an industry of fewer injuries, fewer workplace accidents, and fewer deaths. A construction industry that fully utilizes its construction site safety practices is the kind of industry we should be working towards (Yiu *et al*., 2019).

2.1.10 Factors which influence accident causation on pipeline construction

2.1.10.1 Human factor

The human factor is due to human behavior and attitudes towards safety when at work. The human error and state in which the workers are in may cause an accident. For example accident(s) may occur because the worker(s) is/ are:Drunk, Tiredness, General Laxity behavior about safety, Unaware of the presence of such a risk that may lead to an accident, Human impairment like poor eye-sight of worker and General human error as a person (Scopelliti *et al*., 2018).

2.1.10.2 Technical factor

The technical factor takes on the technical aspects, which could lead to accident, and these include; Badpipeline designs: those that are prone to accident at construction and maintenance level, inadequate designs of structural elements of the pipeline like columns that cannot carry the intended loads etc, Poor quality pipeline materials like low quality cement, reinforcement, poor mix ratios etc Misinterpretations of working plan and detail drawings, Bad construction methods and practices, Incompetent worker-force for implementation of project (Sunil *et al*., 2018).

2.1.10.3 Working Environment factor

Working Environment factor takes on those factors that induce or influence accident causation because of the working situation the workers are exposed to and general condition the surroundings.

It's important to appreciate that workers are sometimes faced with situations and conditions that are dictated by nature, state of operation and other external influencers. Working environment factors include; working in poor weather, working without personal protective wear, working generally in unsafe environment like emergence repair works on a powerhouse that feeds a theatre of a major hospital, etc (Tezel *et al* ., 2021).

2.1.11 Critical Success Factors (CSFs) for safety implementation in the Construction companies

Advantages of the approach of the CSFs are that it focuses on critical high-payoff factors, it is relatively fast and inexpensive to administration, and frequently reveals new insights to the executives involved. Its major disadvantages are that it is not comprehensive and results in a snapshot of the business, which can quickly become obsolete if any major change occurs in the business (Tonmoy*et al*., 2018). Han *et al*. (2012) define SFs as factors that influence, constitute as well as determine the success of a project. SFs are those inputs to the management system that lead directly or indirectly to the success of the project (Umar *et al*., 2018). SFs are further

classified under two main categories, one being hard, and objective, tangible and measurable while the other soft, subjective, intangible and less measurable (Umar *et al*., 2018). According to Sanvido *et al*. (1992) the concept of project success factors was first introduced by Rubin & Seeling (1976) but the term CSFs in the context of project management was first used by Rockart (1982). Rockart (1982) defines CSFs as those relatively small numbers of truly important matters where a particular industry should focus her attention in order to achieve success. According to I-Chen*et al*., (2020) CSFs represent "factors" which are "critical" to the "success" of the industry concerned. CSFs are those factors which are necessary for the project participants to achieve their goals in a project (Yiu *et al*., 2017). It has been agreed that CSFs are vital for managers to improve their organization in the sense that it will indicate that the progress is being made in particular areas. It should be acknowledged that the contribution made by Pinto and his colleagues to this area. Slevin & Pinto (1986) proposed a model with ten generic CSFs which is known as Project Implementation Profile (PIP). Further in 1988, they proposed a more general measure of PS and in the same year (1988a) tested the importance of PIP to PS. The changes in the importance of project CSFs across four stages in the project life cycle were investigated by Pinto & Prescott (1988). In 1990, they investigated the role of a set of project planning and tactical factors across the stages of the project life cycle.

Pinto & Mantel (1990) further contributed by studying the patterns of causes of project failure depending on three contingency variables.

Muller & Jugdev (2012) discussed the impact of seminal contributions by Pinto, Slevin and Prescott. However, it was noted that their studies/sample have included a mixture of different types of projects (projects from different industries) such as construction, information technology, research and development and manufacturing etc. Therefore, their findings have become too general and broad posing a question of the applicability on specific construction projects. CSFs will certainly differ from country to country depending on their respective operating environment, policies and legal constraint. Hence, they are not a standard set of measurement or key indicators, which can be applied to all industry (Yong & Musttaffa, 2012). Chan *et al*. (2004) did a thorough literature review related to CSFs in seven major management journals and identified 44 SFs. Belout & Gauvreau (2004) re-tested in a field study, the theoretical model used by Pinto and Prescott and developed by Slevin and Pinto in order to further investigate the impact of the life cycle stage, type and structure of a project on the relationship between the CSFs and PS. Takim & Adnan (2008) identified 29 factors (project success effectiveness measures) and assessed their level of success criticality to the Malaysian construction projects. In addition to direct studies on PSFs/CSFs, studies on causes/reasons for project delay/failure, causes for cost overrun, project management's issues, bottlenecks and

challenges could also be considered as valuable inputs to identifying CSFs in construction project context. For an example, time extension is a very serious and chronic problem in construction projects (Kazaz & Ulubeyli, 2009, as cited in Kazaz *et al*., 2012) and "time" is very important PSC. Failure factors are exact opposite of the success factors (I-Chen*et al*., 2021).

Odeh & Battaineh (2002) identified 28 causes of project delay in the construction industry in Jordan. In Sri Lanka, no research or, if at all only minimal research, has been done in relation to project management and its contribution to the success of construction projects (Gunasekera, 2009). However, various attempts have been made by different researchers to determine CSFs in construction projects in other countries. A number of variables influencing PS have been proposed. Some variables are common to more than one list, but there is no general agreement on the variables (Chan *et al*., 2004).Yong & Musttaffa (2012) further suggests that CSFs could be grouped under different categories depending on the evaluation dimension that the researchers are looking at.

There are several factors that influence the success of construction organizations, which have been divided into following five main groups:

2.1.11.1 Human Factor

Effective construction organization is characterized by good communication. Team members convey messages, verbally and nonverbally, to each other in ways that are

readily and clearly understood. Also, feedback helps to guide team members and to correct misunderstandings. According to Langford *et al*. (1995), construction is a labor-intensive industry; each project has inputs from a wide variety of disciplines and organizations. So, efficient and effective communications are vital. The effectiveness of the organization also depends on the ability to integrate the workforce into a well-motivated and productive team that is committed to the completion of project and overall success of the firm. Undoubtedly, a sense of collective purpose and meaning needs to be achieved among the diversified and fragmented workforce (Langford *et al*., 1995). In order to achieve success, construction organization has to have cooperative team members with sufficient knowledge and experience among them. Contractor's public relations skills also help to create a favourable image in the community during the project execution. Using good public relations skills a firm can ensure effective professional results and improve its public image (Zhai *et al*., 2019).

2.1.11.2 Financial Factor

Financial health is one of the important factors for a construction company. It is generally believed that a strong financial position of a company increases its capacity to carry out projects more effectively and efficiently. Company can also take calculated risk with prospects of higher returns. It can enjoy a higher credibility and reputation among its clients and suppliers. For these reasons, Warsawski (1996)

declares the financial strength of a company to be an important strategic asset. Ratio Analysis in Financial Statements reflects the financial health of a company by revealing the level of success, failure, and progress of a business (Meir Liraz). Ratio Analysis include Liquidity Ratios, Current Ratios, Quick Ratios, Working Capital, Leverage Ratio, Gross Margin Ratio, Net Profit Margin Ratio, Management Ratios, Inventory Turnover Ratio, Accounts Receivable Turnover Ratio, Return on Assets Ratio and Return on Investment (ROI) Ratio. These Liquidity, Leverage, Profitability, and Management Ratios allow the companies to identify trends in their business and to compare their progress with the performance of others through data published by various sources. The company may thus determine its relative business strengths and weaknesses.

2.1.11.3 Organizational Factor

According to Gunhan and Arditi (2005), companies having a history of strong organizational setup are considered to have a competitive edge. An experienced construction company can propose and execute a better solution for a problem because of having necessary knowhow, technique and skilled work force. Past experience technical knowhow, resources, technical ability and strength of its HR expertise reflect the organizational strength. These are the evaluating factors for a company to getpre-qualified for project in public sector. Category of registration of company in Pakistan Engineering Council, organizational infrastructure/setup, area

of specialization and skills, permanent technical employees, available machinery, technology and resources etc define the organizational strength of a company. Avoidance of litigation by a company against its employers is also an attraction for the clients. Ability of a company to adapt itself to changes and new tasksalso shows its strength (Warszawski, 1996).

2.1.11.4 Technical Factor

This is the era of technology; emphasis is now shifting from labor intensive to mechanized processes for high speed of production with better quality and less variation. Having a competitive position due to its organizational strength on the basis of technology a construction company can survive and protect itself from the changing market conditions and entrepreneurs entering their field of expertise (Abraham and Chinowsky -2002). Adoption of new technology for the construction processes and training and developing of staff for adopting new technology and skills also adds to organizational strength. Most construction firms know the importance of technology and training and development of staff (Fryer-1997).

2.1.11.5 Environmental Factor

Political, market and general environments not only posses threats but also offers opportunities to construction companies. With the globalization effect now there are no boundaries for construction companies to compete and execute projects. It is now

more competitive work environment; skilled workers are also working in other countries bringing diversity and new skills. This environment has created opportunities for companies having strong organizational structure, resources and technology to execute projects in other countries and has threatened the existence of small companies who due to non-availability of resources and lack of knowledge fail to improve their working. Awareness of media and public has also put pressure on the construction companies not to disturb the general environment and follow the generally accepted work principles.

2.1.12 Safety Procedures Available in Nigeria

Compensation of workers discusses basically the insurance policy covering injuries sustained by workers on site. It includes a collection of laws that states clearly benefits injured employees are entitled to in the case of occurrence of any accidents during working hours (Anderson, 2007). Compensation Programmes were designed to reduce litigation for work-related injuries, illness and death. The legislations on Health and safety in Nigeria pipeline construction industry include but not limited to; Labour Act of 1974 modified to Labour Acts 1990, and updated to Labour Act, Cap L1, Laws of the Federation of Nigeria (LFN), 2004; the Factories Act of 1987 which became effective in 1990 and later updated to Factories Act, Cap. F1, LFN, 2004; the Workman's Compensation Act of 1987 which became effective in 1990, modified to Workman's Compensation Act, Cap W6, LFN, 2004 and repeal to

Employee's Compensation Act, No. 13, 2010 of the laws of the Federation of Nigeria, the Insurance Act, 2003 and the Labour, Safety, Health and Welfare Bill of 2012. The National Pipeline Code which is about the worst case scenario that after being approved by the National executive council in 2006 is yet to be enforced. In advanced countries of the world, legislation issues of occupational health and safety (OHS) are taken seriously. That does not neglect the fact that such laws are also in existence in Nigeria but laws or regulations made without proper enforcement is no law at all (Anderson, 2007) .

2.1.13 Principles for pipeline safety

1. Governments should provide leadership and create and maintain administrative frameworks to facilitate the development of a safe and environmentally sound transportation infrastructure, including pipelines.

2.The pipeline operator and/or owner has primary responsibility throughout the whole lifecycle of its systems for ensuring safety and for taking measures to prevent accidents and limit their consequences for human health and the environment. Furthermore, in case of accidents, all possible measures should be taken to limit such consequences (Bryman, 2012).

3. Pipelines for the transport of hazardous substances should be designed and operated so as to prevent any uncontrolled release into the environment.

4. Leaks from any part of a facility or pipeline that contain hazardous substances should be recognized adequately in a quick and reliable way, especially in environmentally sensitive or highly populated areas.

5. The pipeline operator should implement a management system to develop and maintain the integrity of pipelines. The integrity of pipelines should be ensured through adequate design, construction, maintenance, inspection and monitoring and through sound management.

6. Deterministic and/or probabilistic approaches should be used in evaluating pipeline integrity and impacts on human health and the environment.

7. Appropriate measures should be taken in case of accidents. Emergency plans should be established by pipeline operators (internal emergency plans) and by authorities (external emergency plans) and should be tested and regularly updated. These plans should include descriptions of the measures necessary to control accidents and limit their consequences for human health and the environment.

8.Land-use planning considerations should be taken into account both in the routing of new pipelines (e.g.to limit proximity to populated areas and water catchment areas to the extent possible) and in decisions concerning proposals for new developments/construction in the vicinity of existing pipelines (To¨ rner *et al*.,2009).

9.Pipeline operators and the authorities responsible for pipelines should review and, if necessary, develop and implement systems to reduce third-party interference, which is a main cause of accidents, including their transboundary effects.

10.Information on the safety of pipelines, the geographic position of pipelines, safety measures and the required behaviour in the event of an accident should be supplied to persons likely to be involved in case of a pipeline accident. General information should be made available to the public.

11. Regular exchange of information between pipeline operators and authorities regarding good practices, improvement of pipeline safety, and past accidents and near-miss cases should be considered (Cooper *et al*., 2004).

2.1.14 Performance indicators in safety management practice on pipeline construction projects

- **Safety Incident Rate**: Measures the number of safety incidents per 100 full-time workers. A top priority for any construction firm, this identifies job site risks and guides preventative action.
- **Schedule Performance**: Tracks % of projects completed on or ahead of schedule. Meeting deadlines and milestones is critical for avoiding penalties, keeping stakeholders happy, and maximizing profitability.

- **Cost Performance**: Measures % of projects completed within the original budget. Controlling costs is a key focus in construction's tight margins. This helps identify expense overruns to address.
- **Rework Rate**: Calculates the % of work that has to be redone due to errors or poor quality. Minimizing expensive rework is crucial for cost and schedule control.
- **Labor Productivity**: Measures workforce efficiency with metrics like work hours per unit installed. Optimal staffing and productivity controls labor cost overruns.
- **Equipment and Asset Utilization**: Tracks % of available time equipment is actively used on revenue-generating tasks. Proper asset allocation optimizes profits.
- **Overhead Costs**: Compares overhead spending like HR, admin, facilities, marketing against budgets. Controlling indirect costs helps maintain profitability.
- **Profit Margin**: This crucial KPI measures profitability as a % of total revenue. Requires tracking project budget vs. actuals and driving higher margins.
- **Client Satisfaction Scores**: Feedback ratings or surveys from clients provide actionable insight into perceived performance and satisfaction. This drives future business success.
- **Quality Defects**: Measures quality control failures that require rework or replacements. Minimizing defects reduces costly fixes to maintain customer satisfaction.

- **Sustainability**: For companies focused on green construction, track relevant KPIs like waste diversion rates. This measures environmental impact.
- **Safety Training Completion**: Leading indicator of potential future incident rates. Proactive training is key for a strong safety culture.

2.2 Theoretical Framework

2.2.1 Accident Causing Theory

The occurrence of accidents is the result of internal or external joint action. In the initial stage of accidents, there is no specific form of accidents. However, if there are safety problems, these potential dangers will gradually appear in the development period over time and eventually lead to the occurrence of accidents by sudden changes. The purpose of establishing safety evaluation method is to take effective measures to eliminate potential problems and prevent them from mutating into accidents before accidents occur. Then, it is necessary to master the process of accident evolution, in order to do a better job in prevention and ensure the safety of work. Therefore, mastering the theory of accident causation is the premise of our preventive work. The whole analysis process of accident causation theory mainly includes four factors: human, machine, material and environment. Through various experiments and current events, it is finally found that as long as any two factors exist at the same time, the accident wills occur (Idubor and Oisamoje, 2013).

Preventing accidents is extremely difficult in the absence of an understanding of the causes of accidents. Many attempts have been made to develop a prediction theory of accident causation, but so far none has been universally accepted. Researchers from different fields of science and engineering have been trying to develop a theory of accident causation which will help to identify, isolate and ultimately remove the factors that contribute to or cause accidents. In this article, a brief outline of various accident causation theories is presented, followed by a structure of accidents.

When three or more factors exist at the same time, the probability of accidents is higher. The analysis of the theory leading to accidents can provide an effective basis for the formulation of measures to prevent accidents in pipeline construction industry, as well as a basis for safety management.

2.3 Empirical Review

Peter, Grant, Rodgers and Dennerlein (2018) carried out work on a cluster randomized control trial of a total worker health intervention on commercial construction sites. Matched pair cluster randomized control trial conducted on ten worksites five intervention (n=324) five control sites (n=283); workers surveys were collected at all sites pre and post-exposure at one-and six months. Linear and logistic regression models were used to evaluate the effect of the intervention on pain and injuries, dietary and physical activity behaviours, smoking, ergonomic practices and work limitation. They used worker groups and manager-interviews to supplement

the evaluation after controlling for matched intervention and controlled pairs as well as covariates at one month following the ergonomic Programme, they observed a significant improvement in ergonomic practice (B = 0.20, P = 0.002) and a reduction in incidence of pain and injury (OR = 0.58,P = 0.012) in the intervention group. At six months, they observed differences in favour of the intervention group force reduction in physically demanding work (B = 0.25, P = 0.008) increased recreational physical activity (B = 35.2, P = 0.026) including higher consumption of fruits and vegetables are barriers to intervention implementation.

Assessment of various researchers such as: Aniekwu (2007); Idoro 2011; Okolie and Okoye (2012); Idubor and Oisamoje (2013); Dodo (2014); and Umeokafor *et al.,* (2014); on provisions and management of safety in construction project reveals that adoption and compliance with health and safety provision served as catalyst in optimizing construction production process. On the other hand, without compliance to health and safety practices, more accident will result in pains, accidents and legal actions thereby escalating production cost. Based on this, Famakin &Fawehinmi (2012) stated that 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.

The anomalies as seen in the construction firm's failure to comply with minimum requirement of safety practices might cause the victim waste of time and 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 tectonic 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 (Aniekwu, 2007). Thus, the lack of adherence to safety practices will delay the production process of construction activities.

In another research work carried out by other researchers Oakman and Newpane (2017) in synergy with Proper and on workplace intervention to improve work ability; a systematic review and meta-analysis of their effectiveness; they used in their work argument or statement, work-based interventions focused on individuals, the workplace, or multilevel (combination). They used work ability index (WAI) or the single-item work ability score (WAS) to measure outcome of work ability, the work under review, to synthesize the results grade (grades of recommendation, assessment, development and evaluation) criteria was used to assess evidence, quality and impact statements, were developed to synthesize the results. The above researchers reasoned that meta-analysis was undertaken where appropriate. Their results showed that they reviewed 17 randomized control trials (comprising 22

articles) multilevel interventions (n=5) included changes to work arrangements and causes with supervisors, whilst individual focused intervention (n=12) involved behaviour change or exercise Programmes. They identified only evidence of a moderate quality for either individual or multilevel interventions aiming to improve work ability.

Idoro (2011) studied effect of mechanization on Occupational Health and Safety (OHS) performance of the Nigerian construction industry. This study evaluated the level of mechanisation and its relationship to the Occupational Health and Safety (OHS) performance in the industry and also established impact of mechanisation on OHS performance and implored the commitment of contractors to effective OHS management. Questionnaire was adopted and analysed by percentages, means, *t*-tests and Spearman's correlation tests. The results of the study indicated that increase in mechanisation also increased the rates of accident and injury occurrences. This study concluded that failure to effectively manage mechanisation worsen OHS performance on project sites. However, construction managers should devise means of effective measures that will implement control of OHS performance before using new or additional safety wears.

Agwu (2012) conducted a study on total safety management (TSM) an approach for improving organisational performance in selected construction firms in Nigeria. The study adopted stratified and random sampling technique for the copies of

questionnaire distributed among the selected six most famous construction firms operating in Nigeria, they include: (Julius Berger Nigeria Plc, Setraco Nigeria Ltd, Fourgerolle Nigeria Ltd, Arab-Contractors Nigeria Ltd, Dantata & Sawoe Nigeria Ltd and Costain Nigeria Ltd). The outcome of the research suggested that integration of total safety management as part of the organisational policy would lead to improving safety practices on construction projects. The study therefore recommended that, to sustain the advantage of total safety practices in Nigerian, operatives need to maintain good attitudinal behavior and structural modifications in management of construction safety. Babu (2015) study aimed at investigating safety performance on the construction sites. The study soughed the opinion of construction participant using copies of structured questionnaire to appraise safety performances on their construction sites. The outcome revealed inadequate support from the government, insurance companies, ministry of labour, and construction participant.

2.4 Summary of Literature

Health and Safety issues are increasingly serious concerns for the government and industry on legal, moral, and financial grounds. As one of the safest construction industries in the world, Nigeria's construction industry still has a disproportionately high rate of fatal injuries and ill-health. The advantages of the CSF approach are that it focuses on critical high-payoff factors, is relatively fast and inexpensive to

administer, and frequently reveals new insights to the executives involved. Although many efforts have been made to establish a systematic and applicable legal system and improve the performance of the industry, the current situation has not been as satisfactory as could be hoped. H&S culture has been identified as a crucial element to overcome the bottleneck of H&S improvement. A reciprocal model of safety culture revealed three aspects of developing and evaluating a positive H&S culture. An organisation with a positive H&S culture can draw on effective management systems to improve H&S performance, minimise the possibility of accidents, and maximise the project's value.

2.5 Research Gap

Several studies have identified that there are factors that influence the implementation of safety Programmes in construction projects; however, there is a gap in research on what specific factors affect those Programme implementations in construction projects in Nigeria. However, some factors that may potentially affect the implementation of safety Programmes in pipeline construction projects in Nigeria include availability of adequate safety equipment and resources; training levels provided to workers; management commitment to worker health & general well-being. Regulatory issues are also at play here: too much or too little regulation can both negatively impact worker's performance on environment, and the cultural attitudes towards safety in the organisations. Further research is needed to explore

these factors in greater depth and determine their specific impact on safety Programme implementation in pipeline construction projects in Nigeria.

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CHAPTER THREE

METHODOLOGY

3.1 Research design

The researcher used descriptive research survey design in building up this project work the choice of this research design was considered appropriate because of its advantages of identifying attributes of a large population from a group of individuals. The design was suitable for the study as the study sought to examine the success factors affecting safety Programme implementation in pipeline construction projects in Nigeria.

3.2 Sample and Sampling Procedure

Sample is the set of people or items which constitute part of a given population sampling. GreenOcean Pipeline services Ltd has a population of 156 staff/workers, due to large size of the target population, Taro Yamane formula was used to arrive at the sample population of the study.

Questionnaire on the factors affecting effective safety Programme implementation in pipeline projects in Port Harcourt, rivers state, shared to the workers and stakeholders in the pipeline project.

$$n = \frac{N}{1+N(e)^2}$$

Where n signifies sample size, N signifies the population under study, e signifies the margin error (which could be 0.10, 0.05, or 0.01).

$$n = \frac{156}{1+156(0.05)^2}$$

$$= \frac{156}{1+156(0.0025)}$$

$$= 112.2302$$

$$=112$$

3.3 Method of Data Collection

For purposes of the study, primary sources of data were used. According to Kumar (2005) primary sources are sources of data collection where the data is collected for the specific purpose at the time of collection. The primary sources of data were collected primarily through survey of the staff using the questionnaire.

3.4 Method of Data Analysis

The responses obtained from respondents in Greenocean Pipeline Services Limited, Port Harcourt formed data. Each of the stated objectives which are performance indicators in safety management practice, the factors that influence accident causation and success factors for effective safety Programme implementation in pipeline construction projects to aid in decision making process, and better safety management in Nigeria will be answered by the respondents. The data will be treated

statistically in accordance with research questions generated from the study. Tables and simple percentages were used as techniques for analysing the research questions.

Relative importance index (RII):

This is a statistical measure used to assess the relative importance or contribution of different factors or variables in explaining the observed outcomes or phenomenon. For this research RII will help the stakeholders prioritize and understand the relative impact of different variable in the study.

Relative importance index (RII) with formula:

$$RII = \frac{\sum AFi}{(`A*N)}$$

Where, F is Individual Factor (1-5), A is individual number of correspondences, ‘A is total number of correspondence (112), N is highest factor used (5),

Principle Component Analysis (PCA):

It is a statistical technique used for dimensionality, reduction and data compression. PCA aims to transform a dataset into a coordinate system, where the data /variances /factors are maximized along the principal component axes while reducing redundancy and noise (error).

For this research, PCA was used in reducing the complex high-dimensional data/ variables while retaining the essential information.

The KMO table is used to measure the strength of the partial correlation (how the factors explain other) between the variables and the sampling adequacy. Bartlett's test of sphericity is used to test the null hypothesis that the correlation matrix is an identity matrix, an identity correlation matrix means your variables are unrelated and not ideal for a component analysis.

Principle Component Analysis (PCA) is presented as an exploratory general model for uniting the sciences and the humanities through identification and use of critical factors common to both.

3.6.1 Decision Rule

Accept the null hypothesis if the calculated value is less than the tabulated value otherwise; reject the null hypothesis at 5% level of significance.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 RESULT

SECTION A: Demographic Characteristics of Respondent

Table 4.1: Education Qualification

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SSCE / OND	23	20.5	20.5	20.5
	HND / BSC	89	79.5	79.5	100.0
	Total	112	100.0	100.0	

From table 4.1, it could be seen that 20.5% are SSCE / OND holders, while 79.5% HND / BSc holders.

Table 4.2: Position in the company

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Pipeline laborers	27	24.1	24.1	24.1
	Machine operators	23	20.5	20.5	44.6
	Pipe fitters	37	33.0	33.0	77.7
	Welders	14	12.5	12.5	90.2
	Pipeline compliance specialist	11	9.8	9.8	100.0
	Total	112	100.0	100.0	

Table 4.2 explains that 24.1% of the respondents are Pipeline laborers, 20.5% are Machine operators,33% are Pipe fitters, 12.5% are 12.5%, are Welders, while 9.8% are Pipeline compliance specialist.

SECTION B: Factors that Influence Accident Causation on Pipeline Construction Projects

Table 4.3 Factors that Influence Accident Causation on pipeline construction.

S/N	Variables	Code
1	Reluctance to invest / lack of concern for safety by management	P1
2	Lack of technical guidance	P2
3	Lack of training	P3
4	Lack of experienced project managers / skilled workers	P4

5	Lack of enforcement of safety regulation	P5
6	Carelessness and negligence	P6
7	Poor safety consciousness of workers / managers	P7
8	Low level of education of workers	P8
9	Poor maintenance of equipment	P9
10	Lack of personal protective equipment	P10
11	Lack of teamwork spirit	P11
12	Lack of organizational commitment	P12
13	Poor information flow	P13
14	Fatigue by workers because of overwork	P14
15	Shortfall of safety personnel on site	P15
16	Lack of protection of material during transportation / storage	P16
17	Misjudgement of hazardous situation	P17

The table above shows us the factors that Influence Accident Causation on pipeline construction, in other to answer our first objective and identify the factors responsible for accidents in pipeline projects.

In other to achieve this, a pilot test was done, our respondents were asked about the factors that they knew that could cause accident during pipeline projects.

Table 4.4: Relative Importance index of the Factors that Influence Accident Causation on pipeline construction.

Factors	1	AF	2	AF	3	AF	4	AF	5	AF	ΣAFi	RII	Rank
P1	8	8	8	16	6	18	4	16	86	430	488	0.87	5th
P2	6	6	9	18	6	18	6	24	85	425	491	0.88	4th
P3	4	4	6	12	10	30	10	40	82	410	496	0.89	3rd
P4	6	6	8	16	6	18	8	32	84	420	492	0.88	4th
P5	6	6	6	12	6	18	12	48	82	410	494	0.88	4th
P6	4	4	2	4	6	18	8	32	92	460	518	0.93	1st
P7	6	6	6	12	8	24	8	32	86	430	504	0.90	2nd
P8	4	4	4	8	10	30	6	24	88	440	506	0.90	2nd
P9	2	2	10	20	10	30	10	40	80	400	492	0.88	4th
P10	10	10	8	16	6	8	8	32	80	400	466	0.83	8th
P11	4	4	8	16	10	30	8	32	82	410	492	0.88	4th
P12	5	5	6	12	8	24	10	40	83	415	496	0.89	3rd
P13	5	5	5	10	8	24	7	28	87	435	502	0.90	2nd
P14	6	6	9	18	8	24	9	36	78	390	474	0.85	7th
P15	5	5	6	12	8	24	11	44	82	410	495	0.88	4th
P16	7	7	7	14	8	24	9	36	80	400	481	0.86	6th
P17	4	4	3	6	13	39	8	32	82	410	491	0.88	4th

Source: Questionnaires and SPSS software on accident causation analysis using RII

From Table 4.4, a critical observation of the ranked measures reveals the following results in terms of the importance indices and ranking of the factors that Influence accident causation on pipeline construction. From the study, carelessness and negligence was ranked first with a RII of 0.93; Poor safety consciousness of workers / managers, Low level of education of workers, Poor information flow was ranked second with a RII of 0.90; Lack of training , Lack of organizational commitment, Lack of experienced project managers / skilled workers, was ranked third with a RII of 0.89, Lack of technical guidance, Lack of enforcement of safety regulation, Shortfall of safety personnel on site, Misjudgement of hazardous situation was ranked fourth with a RII of 0.88; Reluctance to invest / lack of concern for safety by management was ranked fifth with a RII of 0.87; Lack of protection of material during transportation / storage was ranked 6^{th} with RII of 0.86; Fatigue by workers because of overwork was ranked 7^{th} with RII of 0.85 while Lack of personal protective equipment was ranked 8^{th} with RII of 0.83.

The RII was used to identify and prioritize the factors that influence accident causation on pipeline construction projects, the mean ranking shows the factors that contribute more/ less to accidents in pipeline construction projects.

Section C: Factors influencing effective Safety Programme implementation on Pipeline Construction Projects

To identify the factors that affect safety Programme implementation on pipeline construction projects of Greenocean Pipeline company, Port Harcourt, a principal component analysis will be done to reduce the number of variables that do not have a strong impact in the safety management practices.

Table 4.5 Descriptive Statistics

	Mean	Std. Deviation	Analysis N
Personal attitude	3.21	1.396	112
Motivation	3.03	1.417	112
Safety meeting	2.79	1.447	112
Continuing participation	3.00	1.395	112
Appropriate supervision	3.32	1.459	112
Training	2.88	1.356	112
Equipment and maintenance	2.90	1.349	112
Personal competency	2.99	1.467	112
Pre task planning for safety	3.14	1.307	112
Site system inspection	3.15	1.490	112
Technology	3.10	1.382	112
Communication	2.98	1.483	112
Allocation of authority and responsibility	2.95	1.432	112
Appropriate resource allocation	2.71	1.380	112
Hazard identification	2.98	1.362	112
Management support	3.21	1.490	112
Teamwork	2.92	1.409	112
Clear and realistic goals	2.99	1.352	112
Safety policies.	2.93	1.463	112

The table above show us the descriptive analysis of the practices (variables) used in safety management in Greenocean Pipeline Services Limited, the table shows us there means, standard deviation and number of responses.

ASSUMPTION OF PRINCIPAL COMPONENT ANALYSIS

The Principal Component Analysis (PCA) was used to identify factors influencing effective safety Programme implementation on pipeline construction projects in Nigeria.

Table 4.6 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.417
Bartlett's Test of Sphericity	Approx. Chi-Square	166.929
	df	171
	Sig.	.574

The KMO table is used to measure the strength of the partial correlation (how the factors explain other) between the variables and the sampling adequacy.

Bartlett’s test of sphericity is used to test the null hypothesis that the correlation matrix is an identity matrix, an identity correlation matrix means your variables are unrelated and not ideal for a component analysis.

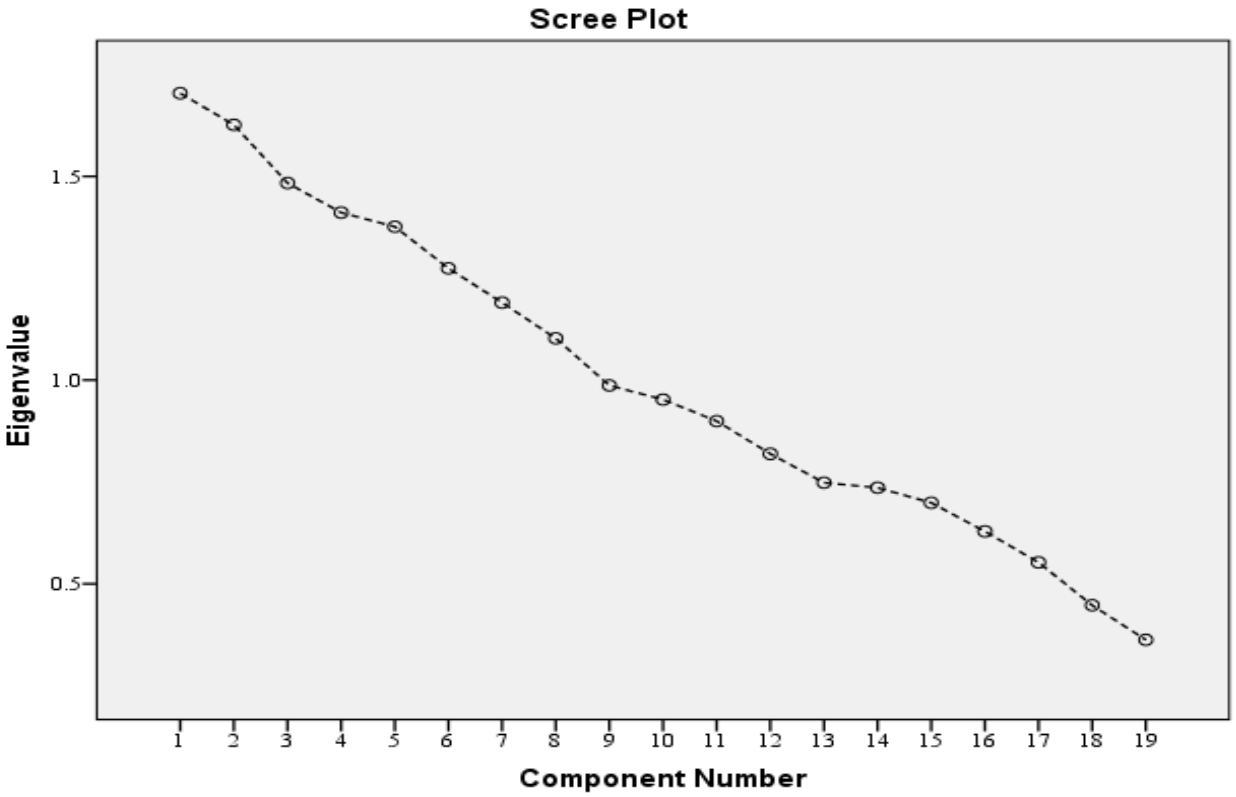
Table 4.7 Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.704	8.968	8.968	1.704	8.968	8.968
2	1.627	8.561	17.529	1.627	8.561	17.529
3	1.484	7.808	25.337	1.484	7.808	25.337
4	1.411	7.427	32.764	1.411	7.427	32.764
5	1.377	7.245	40.009	1.377	7.245	40.009
6	1.274	6.706	46.715	1.274	6.706	46.715
7	1.190	6.264	52.979	1.190	6.264	52.979
8	1.102	5.802	58.782	1.102	5.802	58.782
9	.987	5.194	63.975			
10	.952	5.012	68.987			
11	.899	4.734	73.721			
12	.819	4.311	78.031			
13	.748	3.938	81.969			
14	.736	3.873	85.842			
15	.699	3.678	89.520			
16	.629	3.309	92.830			
17	.553	2.908	95.737			
18	.447	2.354	98.092			
19	.363	1.908	100.000			

Extraction Method: Principal Component Analysis.

The Total variance explained table is used to measure of variance explained by each of the extracted factors, note that the first eight factors have eigen values (measure of variance explained) greater than 1 which is a common criterion for a factor to be useful, when the eigen value is less than 1.0 the factor explains less information than a single item would explain.

from the cumulative % variation column we can see that 78% of the variation is explained by the first 12 components, for the sake of this research we will be working with component with eigenvalues values above 1, which is the first 8 component.



The scree plot.

The scree plot is used to plot the eigenvalues against the number of components, it is used to measure the number of variations explained by the components. From the plot we can see that most of the variation are explained between the 8th and 12th components, and that the variation explained decreases as the components increases.

Table 4.8Communalities

	Initial	Extraction
Personal attitude	1.000	.512
Motivation	1.000	.572
Safety meeting	1.000	.692
Continuing participation	1.000	.516
Appropriate supervision	1.000	.704
Training	1.000	.458
Equipment and maintenance	1.000	.566
Personal competency	1.000	.576
Pre task planning for safety	1.000	.662
Site system inspection	1.000	.439
Technology	1.000	.754
Communication	1.000	.658
Allocation of authority and responsibility	1.000	.721
Appropriate resource allocation	1.000	.502
Hazard identification	1.000	.544
Management support	1.000	.450
Teamwork	1.000	.563
Clear and realistic goals	1.000	.652
Safety policies.	1.000	.629

Extraction Method: Principal Component Analysis.

Communalities: this is the proportion of each variable's variance that can be explained by the factor. It is also noted as h^2 and can be defined as the sum of squared factor loadings for variables.

Extraction: the values in the column explain the proportion of each variable's variance that can be explained by the principal components. The variables with high extraction values are well explain, and the variables with low extraction values are less explained, this shows that technology is the most explained and site inspection is the less explained.

Table 4.9Component Matrix[a]

	Component							
	1	2	3	4	5	6	7	8
Personal attitude	.139	.166	-.215	.411	.089	.424	-.003	-.251
Motivation	.477	.115	.180	.285	.171	-.217	-.051	.372
Safety meeting	-.484	-.181	.014	.350	-.073	-.413	-.257	-.244
Continuing participation	.155	-.229	.332	-.215	-.492	-.009	.039	.199
Appropriate supervision	.443	-.218	.069	-.149	.347	.204	-.498	-.154
Training	.308	.405	-.111	.358	-.064	.130	-.110	.159
Equipment and maintenance	.390	-.230	-.102	-.004	-.416	.262	-.222	-.246
Personal competency	.097	-.064	.568	.393	-.073	.250	-.045	.123
Pre task planning for safety	-.169	.096	-.269	-.120	-.363	-.233	-.372	.461
Site system inspection	.254	.438	-.272	.144	-.043	-.111	.261	-.075
Technology	.100	-.419	-.518	-.018	.303	.120	.175	.404
Communication	.241	-.531	-.320	.088	-.054	-.133	.424	.082
Allocation of authority and responsibility	-.236	-.086	.407	-.314	.169	.495	.263	.224
Appropriate resource allocation	-.197	-.155	-.143	-.224	.524	-.024	-.269	-.146
Hazard identification	-.201	.563	-.242	-.183	.021	.231	.197	-.031
Management support	-.565	.000	.063	.263	-.093	.178	.126	.032
Teamwork	.105	.431	.249	-.233	.341	-.270	-.098	.227
Clear and realistic goals	.310	.154	.057	-.532	-.227	-.177	.201	-.350
Safety policies.	.152	-.124	.338	.234	.284	-.391	.381	-.206

Extraction Method: Principal Component Analysis.
a. 8 components extracted.

The components matrix table shows us the variables that are correlated to the components, for this research we have selected only 8 components, from the table any value greater than 0.4 is correlated to the corresponding principal component.

From the components matrix we can see that Motivation and Appropriate supervision are positively correlated to the principal component 1 (PC1), this means that an increase in motivation and/or Appropriate supervision will increase (PC1).

From the components matrix table, we can also see that training, site system inspection, hazard identification, teamwork are positively correlated to the principal component 2 (PC2), which suggests that an increase or decrease in training, site system inspection, hazard identification, teamwork will lead to an increase or decrease in PC2.

From the components matrix we can see that personal competence and allocation of responsibility and authority are positively correlated to the principal component 3 (PC3), this means that an increase in personal competence and/ or allocation of responsibility and authority will increase (PC3).

The components matrix table also shows that personal attitude is positively correlated to the principal component 4 (PC4), and an increase or decrease in personal attitude will increase or decrease the (PC4). And so on.

4.2 DISCUSSION

$H0_1$: Performance indicators in safety management practice do not significantly have effect on pipeline construction projects.

It was concluded from secondary data done by other researchers that Performance indicators in safety management practice have significant effect on pipeline construction projects which is also in line with the safety practices performed in

Greenocean pipeline construction like personal attitude, motivation, technology, supervision etc.

$H0_2$: The factors that influence accident causation on pipeline construction projects in Nigeria cannot be identified and prioritised.

The null hypothesis was accepted at > 0.005 and concluded that carelessness and negligence was ranked first with a RII of 0.93 while Lack of personal protective equipment was ranked 8^{th} with RII of 0.83

$H0_3$: The identified factors that affect safety Programme implementation has no significant effect on successful pipeline construction projects in Nigeria

The null hypothesis was accepted at > 0.005 and concluded that the factors are all significant and further grouped into 8 components with (PC1) motivation and/or appropriate supervision considered to be most significant while Pre task planning for safety and Technology as the least significant with (PC8)

CHAPTERFIVE

CONCLUSIONANDRECOMMENDATION

5.1 Conclusion

The aim of this study is to determine the factors affecting effective safety Programme implementation in pipeline construction projects in Nigeria. Interviews were conducted with industry practitioners in the Nigerian construction industry.

The interviewees were asked about the factors that influence accident causation in pipeline construction and it was confirmed from the respondents Using relative importance index that carelessness and negligence is most reason accidents occur, from the 17 factors that influence accident causation in Greenocean Pipeline Services Limited, Port Harcourt.

The interviewees confirmed 19 performance indicators are used by Green Ocean Pipeline Construction Company. A principal component analysis was conducted to identify the most important performance indicators in order to enable Green Ocean Pipeline Construction Company to promote the performance of its staff more effectively. The study was crucial for the 112 stakeholders in the company in order to enable them to manage human and capital resources effectively. The 19 factors that are used by Greenocean Pipeline Services Limited were scaled down to 8 crucial components based on the correlation between the factors (variables). Factors that are more correlated were put into the same component; an example is that motivation

and appropriate supervision are positively correlated and are put into principal component 1 (PC1).

5.2 Recommendations

The following recommendations were put forward:

i. It has been concluded that carelessness and Negligence is the most significant factor accident occurs in Pipeline Construction Projects in Nigeria and Top management and stakeholders should ensure that workers are motivated to take safety seriously in project sites and that they are properly supervised by the H & S officers while they carry out their activities on site.
ii. These findings can be used to help guide construction companies in Nigeria to develop a strategy to implement safety Programmes appropriately.
iii. Regulatory bodies should create strong penalties for companies/individuals that fail to keep to safety rules in project sites.
iv. Further research may be carried out to establish the relationship between the Critical Success Factors of safety Programme Implementation on construction projects and associated delay/failure factors.

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APPENDICES

Appendix 1: Introductory letter to the questionnaire

Department of Project management Technology
Federal University of Technology
P.M.B 1526, Owerri
Imo State

Dear Respondents

I am Nneamaka Chioma Mbachu, from Federal University of technology, pursuing a Masters Degree in Project management technology. I'm interested in learning more about **success factors affecting safety Programme implementation in pipeline construction project in Nigeria.**I will ask you several questions. The information you provide will be used to develop better education Programmes for construction stakeholders. DO NOT write your name on this questionnaire. The answers you give will be kept strictly confidential; they will only be used for statistical analysis. No one will know what you write. Answer the questions based on what you really do and to the best of your ability. Completing the survey is voluntary. If you don't want to answer a question, just leave it blank.

Yours faithfully

.....

Appendix II: Questionnaire

Instruction: Please tick (√) on your most preferred choice(s) on a question

SECTION A: Demographic Characteristics of Respondent

1) Gender ☐
   Male ☐
   Female ☐

2) Education qualification
   SSCE / OND ☐
   HND / BSC ☐

3) Position in the company ☐
   Pipeline labourers ☐
   Machine operators ☐
   Pipe fitters ☐
   Welders ☐
   Pipeline compliance specialist ☐

Section B: Factors that influence accident causation on pipeline construction

S/N	Variables	SA	A	N	D	SD
1	Reluctance to invest / lack of concern for safety by management					
2	Lack of technical guidance					
3	Lack of training					
4	Lack of experienced project managers / skilled workers					
5	Lack of enforcement of safety regulation					
6	Carelessness and negligence					
7	Poor safety consciousness of workers / managers					
8	Low level of education of workers					
9	Poor maintenance of equipment					
10	Lack of personal protective equipment					
11	Lack of teamwork spirit					
12	Lack of organizational commitment					
13	Poor information flow					
14	Fatigue by workers serious of overwork					
15	Shortfall of safety personnel on site					
16	Lack of protection of material during transportation / storage					
17	Misjudgement of hazardous situation					

SECTION C:Critical Success Factors for Safety Practices and implementation on pipeline Construction

S/N	Variables	SA	A	N	D	SD
1	Personal attitude					
2	Motivation					
3	Safety meeting					
4	Continuing participation					
5	Appropriate supervision					
6	Training					
7	Equipment and maintenance					
8	Personal competency					
9	Pre task planning for safety					
10	Site system inspection					
11	Technology					
12	Communication					
13	Allocation of authority and responsibility					
14	Appropriate resource allocation					
15	Hazard identification					
16	Management support					
17	Teamwork					
18	Clear and realistic goals					
19	Safety policies.					