Novateur Publications
International Journal of Innovations in Engineering Research and Technology [IJIERT]
ISSN: 2394-3696 Website: ijiert.org
Volume 12, Issue 10, October – 2025

EVALUATION OF BEHAVIOUR-BASED SAFETY AS AN INCIDENT PREVENTION TOOL IN SELECTED CONSTRUCTION COMPANIES IN PORT-HARCOURT

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Article History: Received on: 27/07/2025
Accepted on: 05/10/2025

DOI: https://doi.org/10.26662/ijiert.v12i10.pp1-17

Abstract

This research was conducted to evaluate the effectiveness of behavior-based safety (BBS) approach as an incident prevention tool in selected construction companies in Port Harcourt. Analytical cross-sectional research design approach was adopted. Primary data were sourced through administration of a structured questionnaire. The population comprised of 542 workers (70 from small scale, 472 from medium scale company) from which 230 participants were sampled. 230 questionnaires were distributed and only 199 questionnaires were correctly filled and returned representing 86.5% response rate. Data analysis was done using SPSS version 25.0 software and Excel statistics while descriptive statistics and Pearson correlation were used for data analysis. The results of the Pearson correlation analysis showed that there is a significant and positive relationship between BBS and incident prevention because the correlation coefficient r is 0.602 indicating strong positive relationship and p-value is 0.000<0.01indicating significant relationship. This means that continuous improvement in the BBS approach will lead to a great reduction of incidents in construction companies. This suggests that the tendency of occurrence of incidents decreases as BBS rises. Results also reveals that there are some practices and behaviors identified by the BBS approach that might significantly influence incident prevention, as shown by the relatively strong positive association. Methodically collecting and analyzing data on safety behaviors and observations, training and education, employee participation, safety equipment and resources, workload and time pressure, and enhancing safety based on BBS findings were all components of this particular activity. There was a high probability that incidents will rise in the organizations unless these practices are implemented. The study recommended that construction firms should implement a comprehensive BBS program and create a positive safety culture that encourages employees to speak up about safety concerns.

Keywords; Behaviour-Based Safety (BBS), Incident Prevention Tools, Construction Companies, Port-Harcourt.

1. Introduction

Construction is an inherently dangerous industry that comprises a wide range of activities associated with large structures like houses, factories, railways, shipbuilding, offshore platforms power plants, etc. where workers are exposed to a variety of occupational hazards (OSHA, 2020). Data obtained from the U.S. Bureau of Labor Statistics (BLS) (2020), indicate that close to five thousand (5,000) U.S construction workers died on-the-job between 2015 to 2019, which averages to nearly three (3) construction fatalities per day (BLS, 2020). Because of this, the construction industry continues to face incidents resulting in severe consequences like injuries, fatalities, equipment damage and project delays. Construction is relative to specified geographical locations and does not exist in a vacuum. It is a project-based sector with distinct job activities and attendant risk which are characterized by rugged environments, multiple resources, complex activities and harsh working conditions that makes it a high risk thereby endangering the safety and health of workers (Awolusi et al., 2022). Construction is considered to be the most significant industries in terms of its impact on health and safety of employers and employees.

Construction industry plays an important and dynamic role in the socio-economic development goals of providing shelter, infrastructure and employment and its multiplier effects extends and links with various industries like tiles, iron and steel, chemicals, cement, paints, fabrication, factures and fittings etc. Nigeria as a developing country earns a gross domestic product (GDP) of 4.18% from the construction sector (Tanko et al., 2017). Incidents can affect the workers family, the community, and also decrease the amount of worker resources available in the industry. It can influence project cost, schedule and quality. In United States, 20% of fatal accidents is attributed to the construction industry (Gurcanli & Mungen, 2013). Work related fatalities due to falls, slips, and trips increased 5.6 percent in 2021, from 805 fatalities in 2020 to 850 in 2021. (Bureau of labor statistics, 2020). Nigeria been a developing country is no different case as the rate of incident is even worse in comparison to the developed nations. A study on casualty trends in Lagos, Abuja, and Port Harcourt found that between 2000 and 2010, the building construction sector suffered the highest casualty rates in Lagos, followed by Abuja and then Port Harcourt (Ede, 2010). In the year 2014 over one hundred and twenty deaths related to building collapse was recorded in Lagos. Similar stories go for cities like Port-Harcourt, and Abuja, (Akinyemi et al., 2016).

There has been a significant decline in worker productivity in construction companies globally owing to the increase in accidents and fatalities due to unsafe behavior among workers, although many studies have explored the incidence of unsafe behaviors among construction workers, limited studies have attempted to evaluate the causal factors and to determine the root causes, (Sathvik, et al., 2023). In a review of construction site safety literature, as cited by Stig et al., (2019), there is little research on the key causes (root) and contributory factors of unsafe behaviours and incidents in construction companies. Behavior based safety and incident prevention at work is the subject of continuous debates, studies and researches. Reason (2009) argues that human behaviors are the primary cause of incidents; these behaviors are sometimes intentional and other times, unintentional. Geller et al. (2013) buttress and argue that unsafe behaviors cause most of the incidents in the construction sector. It therefore follows that, if wrong acts can be reduced, incidents will be reduced as well which is the basis of this study.

Studies have been carried out on management system, equipment, organizational and social factors, with little or no attention to human factor as a causative agent of accident particularly in the construction industry. With all the incident statistics mentioned earlier in this text, one would agree that there is an ardent need to investigate and analyze root causes of incidents as well as behavioral based safety (BBS) so as to prevent incident occurrence. Behavior based safety (BBS), on the other hand, is a safety based on behavioral observation (Niciejewska & Obrecht, 2020). It was developed by behaviorist who assumed that people learn from the effects of their behavior, with a tendency to repeat such behavior that brought pleasure and to refrain from those that brought harm. The BBS concept is based primarily on mutual observation of employees and paying attention to potentially dangerous behaviors in others that results to incidence occurrence.

Despite advancements in safety practices, the construction industry continues to face incidents resulting in severe consequences like injuries, fatalities, and equipment damage and project delays. It is crucial to identify the root causes of these incidents and evaluate the effectiveness BBS in order to develop targeted preventive measures. Numerous studies indicate that the human factor remains a significant contributor to these incident root causes. As a result, identifying the crucial human elements involved and finding effective ways to manage them has become a challenging task. The problem at hand lies in the need to understand the underlying causes of incidents occurring in construction projects and the effectiveness of behavior-based safety measures in preventing such incidents. This research is targeted to address these gaps and contribute towards enhancing safety practices in construction industry. Additionally, exploring the implementation and impact of behavior-based safety approaches can provide valuable insights into improving safety culture and reducing incidents within the construction industry. Thus, this study seeks to focus on evaluating the effectiveness of BBS by establishing its relationship with incident prevention within the context of construction companies in Port-Harcourt. The study focused on achieving three main objectives; one, to identified the root causes of incidents among selected construction companies in Port-Harcourt, two, analyzed the effectiveness of BBS approach in identifying and correcting unsafe acts within the construction firms in Port-Harcourt and lastly evaluate the nexus between BBS and incident prevention within the context of construction in Port-Harcourt.

2. Literatures

2.1.1 Incident Investigation

It is common practice for construction firms to launch inquiries into incidents in order to determine what went wrong. Companies use the results of these investigations to manage safety performance proactively by minimizing risks in advance via initiatives such as safety training and audits. Even though many studies have developed models to determine what causes accidents, investigators' expertise is still crucial for getting to the bottom of things. Improving risk mitigation requires not only identifying but also measuring and controlling incident underlying causes. Because of the complexity of incident occurrences, construction businesses typically have difficulties in determining and collecting data that adequately represents these underlying causes. It is possible that the complex causal linkages among identification, measurement, and control are to blame for these problems. But, since projects usually have limited safety budgets, it is very critical to determine these correlations. Companies must prioritize safety and choose the best way to allocate resources (Wirth & Sigurdsson, 2008).

To mitigate risks proactively, it is necessary to be able to monitor and manage the causes of incidents. However, finding and collecting data that accurately represent these underlying causes is problematic in reality due to the complexity of event occurrence processes. Practical root cause identification still relies significantly on investigators' subjective views, notwithstanding prior research on incident causation models. If you want to get to the bottom of an accident, you have to break down the whole thing into smaller parts and look closely at each one to see how important it is. Because of the need for organized thinking, this could be challenging for certain people. An accident investigator has to thoroughly and methodically examine evidence in order to determine what elements caused the accident, and they need to follow a systematic approach to outline the events that led up to the accident. When an accident investigation enters its analytical phase, the first step is to gather relevant details about the event and use them to piece together what happened. The causes that cause something to happen are drawn from this order. Following this systematic process allows the investigator to pinpoint the source of the problem and devise solutions to stop it from happening again.

The time needed to undertake an accident investigation is directly proportional to the incident's complexity, according to a basic principle of investigations. There are accidents that are complex and include many workers, pieces of machinery, and processes, and there are accidents that are simple and involve only one worker and one tool. Every accident, whether it's a near miss, property damage, or injury, is complicated in its own way, and it takes time to investigate, dissect, and analyze each one. A shorter inquiry may be justified for a small harm, while a more involved near-miss may need a longer one. The intricacy, not the severity, of the accident determines how long the inquiry takes (Oakley 2012).

An accident investigation's primary goal is to identify and resolve any issues that may have occurred. Too often, accident investigators focus on determining the reason rather than addressing it. Connecting data, analysis, cause elements, and remedial measures are the foundations of accident investigation. Gather all of the evidence and find out what happened during the accident first. If you want to know what happened in what order, you have to look at the facts. When the chain of events is known, you can identify the ones that have a causal impact. After you've identified the root causes, you may take the necessary steps to address the issues. To avoid such mishaps in the future, it is essential to establish a connection between data analysis, cause variables, and remedial measures. An accident inquiry is based on this connection see figure 2.1

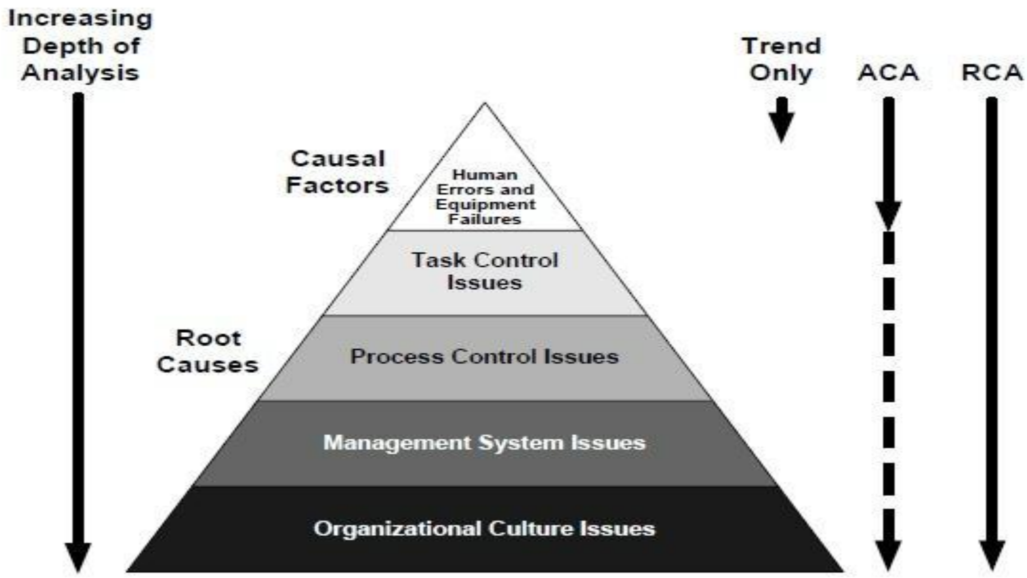

Figure 2.1. Incident Investigation Level of Analysis (Source: Wirth & Sigurdsson, 2008)

2.1.2 Incident Prevention Techniques

Safety solutions have been developed to safeguard construction sites against accidents and improve their overall safety performance. As pointed out by (Hinze et al.,1998), understanding the key elements that lead to accidents is the first step in preventing them. Experiencing or being a witness to a devastating occurrence may have a lasting impression. When this kind of disaster causes major harm or death in an area where you are responsible, the effect is magnified. Compared to countries with more developed economies, the Middle East has a much higher incidence of occupational accidents and fatalities, with 18.6 per 100,000 workers. As

stated by Hallowell et al. (2020), the lack of strict safety and construction regulations, the presence of unskilled foreign workers, and high unemployment rates are the root causes of developing countries' subpar safety performance. In addition to the human cost in lives lost, property damage, and impairments sustained by victims, the monetary cost of accidents is immense, amounting to billions of dollars. Because of this less-than-ideal safety record, several countries have put a lot of money into safety regulations, such as the Occupational Safety and Health Administration (OSHA) in the US, to try to achieve the goal of zero injuries.
The construction business is still seen as one of the most dangerous, according to Ogetii (2019), even if it is well-regulated. Working in construction is still quite risky. The idea of prevention through design (PTD) and design for safety (DFS) is gaining popularity as a means to eradicate several dangers. Avoiding an issue altogether is the better course of action, both in theory and in practice, than dealing with it after it has already arisen. The idea behind PtD is this. Incidents on the job site slow down the project, increase costs, and have an impact on social and environmental sustainability. Minimizing the possibility of construction events at the design phase is an effective method to avoid and manage them. The primary objective of PTD/DFS is to minimize potential dangers by picking the right design choices. Hare et al., 2006; Saifullah & Ismail (2012), suggested incorporating health and safety into pre-construction planning to avoid incidents altogether. The PtD program was initiated in 2007 by the National Institute of Occupational Safety and Health (NIOSH). In the same way that Safety through Design aims to "design out" or limit risks and hazards, PtD does the same. The best approach to decrease risk and control occupational diseases, injuries, and deaths is to eliminate or prevent risks, as is known to experienced safety experts. Workplace incident prevention strategies including work hazard analysis, safe operating procedures, and work safety observations are task-specific. Generally speaking, their goal is to deal with and find any risks that may be present on the job.
Accident rates in the construction industry remain high, despite the significant amount of research and changes that have been implemented over the years (Mosly, 2015). Reacting to construction mishaps is never cost-effective compared to being proactive in preventing and mitigating them. Insurance rates and total project expenses may be reduced when owners work with safety-conscious design teams. Some still believe that carelessness on the part of workers is the primary cause of accidents on construction sites, while others see planning for safety as a way to make workplaces safer (Gambatese, 2004). Problems on the job site may put a damper on morale, drive up expenses, and even ruin a contractor's credibility. The goal of designing for safety (DFS), which is referred to as prevention through design (PTD) in the occupational safety and health (OSH) sector, is to rectify this deficiency. Sustainability in design is possible with its help, as is the maximization of energy efficiency, public and worker safety, and environmental returns. In order to "design out or limit hazards and risks early in the design process" (NIOSH), which is "one of the greatest strategies to prevent and manage occupational accidents, illnesses and deaths," PTD/DFS is founded on. The use of PTD tools may provide designers with the knowledge and resources they need to identify risks and remove hazards, which is particularly helpful when working with big and complicated projects. The capacity to affect safety is supposedly greatest during the design process and dramatically diminishes thereafter, according to Szymberski (1997).
According to a number of studies, accidents, injuries, and deaths may be prevented or significantly reduced if safety is considered throughout the design process. The degree and severity of the relationship between design aspects and construction mishaps are investigated by Behm (2005). According to Behm (2005), who examined 224 cases chosen at random from NIOSH's Fatality Assessment Control and Evaluation program, project design was directly associated with 42 percent of the deaths that were examined. This finding suggests a strong correlation between design and construction safety. After reviewing 100 construction mishaps, Gibb et al.

(2004), found that modifications to the permanent design may have prevented almost half of them (47%). If safety had been more of a priority during the design phase, 60% of the occurrences that were studied might have been prevented, mitigated, or eliminated, according to the European Foundation (1991). Rather of attempting to manage safety within an inherently dangerous process, it is more economical to include safety into the design of the process from the start. Unfortunately, designers are often unaware of how their work affects construction safety and lack the expertise to effectively address safety concerns.

2.1.3 Behavior-Based Safety (BBS)

"The Behavior of Organisms," written by B.F. Skinner in 1938, is the basic book of behaviorism and the inspiration for Behavior-Based Safety (BBS). Skinner lays forth a scientific approach to studying and changing behavior in this book. In his view, living things modify their acts in response to environmental cues, reducing the frequency of negative outcomes and increasing the frequency of good ones. Beyond the domain of safety, Behavior-Based Safety (BBS) borrows ideas from a number of well-established and extensively used academic disciplines. Herbert William Heinrich, in his 1931 book "Industrial Accident Prevention, a Scientific Approach," highlighted the importance of risky habits in safety results. This may be the genesis of the idea of applying behavioral principles to workplace safety. The validity of Heinrich's views, however, was not confirmed by evidence-based study until the late 1970s (SultzerAzaroff & de Santamaria 1980; Heinrich et al., 1980). There is nothing particularly new about using BBS as a means to improve safety culture. Heinrich found that although poor working conditions were responsible for 10% of accidents and occupational diseases, workers' hazardous activities were responsible for an alarming 88%.

Baseline Behavior Support (BBS) is essentially "creating a safety partnership between management and workers that constantly focuses people' attention and actions towards their own and others' everyday safety behaviors" (Kabil & Sundararaju, 2019). Standardized procedures including baseline assessments, feedback, goal formulation, and intervention are used to accomplish this aim. As a preventative measure, Behavior-Based Safety (BBS) aims to encourage safe behavior in designated contexts. The core principle of BBS is the reduction of risks, dangers, and occurrences via the study of individual behavior and its repercussions. This entails determining the results of specific activities and rewarding the right behaviors with the right kind of reinforcement. Trust and cooperation between management and staff are the bedrock of BBS. Its value comes from the fact that it promotes a safety culture, which is essential for long-term success on the job, by providing long-term answers to problems related to risk and hazard reduction. The Health and Safety Authority states that businesses should strive to foster an all-encompassing safety culture under their control. We accomplish this when every employee prioritizes safety and looks out for their coworkers' well-being. According to Safety Culture (2023), the main goals of the BBS method are the reduction of dangerous behaviors and the continuous improvement of safety performance.

One strategy for reducing the likelihood of harm in the workplace is behavior-based safety, or BBS. Applying safety procedures based on workers' real-world activities in work contexts is what BBS safety is all about. Taking personal and communal responsibility for one's own and other people's safety is ingrained in it. Accidents and injuries may occur as a result of unsafe activity. It stands for a scientific approach to improving workplace safety by transforming risky habits for the better. In order to eradicate risky conduct, a BBS system looks at people's workflows, determines why they do things a specific way, and then intervenes. Applied behavior analysis is where it all began. Subsequent research confirmed that BBS programs' efficacy may last for a long time. Although engineering controls are better at removing a specific danger, behavioral therapies may usually address numerous risks, leading to a decrease in injuries of all kinds. Among the many methods for reducing workplace injuries, BBS has the greatest empirical support, thanks to a regular stream of case studies (Hagge et al., 2017; Myers et al., 2010). BBS is an all-encompassing method that combines the best practices of Total Quality Management, organizational development, behavioral analysis (a branch of psychology), and safety procedures. What we call this group effort is "behavior-based safety." Although behavior modification yields quicker improvements, especially when dealing with concrete, obvious problems, the Total Quality Management (TQM) method of safety provides long-term benefits. Lessening the occurrence of accidents and injuries in the workplace is the main goal of this movement.

The favorable results documented in academic journals and safety publications may be attributed to the integration of safety with recognized and proven strategies for behavior change and quality improvement. The idea of behavior-based safety (BBS) involves the systematic implementation of behavioral psychology research with the goal of replacing risky habits with more secure ones. The idea of BBS is to provide businesses the resources they need to change the way their workers think and act when it comes to safety. To improve safety on the job, the micro-BBS technique encourages workers to change their habits. There are seven essential elements to this behavioral safety process: Recognizing actions that might cause trouble, such those that could be dangerous. Identifying what is causing these behaviors to occur. coming up with possible solutions. Assessing how well these remedial actions worked. Creating a plan to put the BBS program into action. Carrying out the BBS software execution and determining whether the BBS software has solved the issue and increased safe behavior by analyzing the acquired data. Contrarily, the goal of most firms' safety programs is to establish a culture of safety, and the macro-BBS strategy aims to do just that. This long-term answer to workplace safety was developed by Michael Topf and implemented via a six-step procedure. Following is a breakdown of these six steps:

i. Assess and examine the current culture of the workplace.
ii. Instruct all workers in the art of behavior-based safety in the workplace.
iii. Encourage full participation in the BBS program by all staff members.
iv. Instruct in self-awareness, -management, -responsibility, and -observation.
v. Remain devoted and supportive to workers at all times.
vi. Provide continuous feedback and assessment.

Employees are encouraged by behavior-based safety systems to seek out the root reasons of their accident-prone patterns of behavior. It gives them the ability to identify patterns of actions that put them in danger. It puts the power to prevent safety mishaps squarely on the shoulders of the workers. As a result, workers take more initiative to safeguard themselves on the job and are less susceptible to hazards. Between 1973 and 2010, the construction sector had a steady decline in both deaths and total incident rates, according to the Bureau of Labor Statistics (BLS, 2020). Implementation of new safety rules, optimization of safety processes utilizing lagging indicators, and the adoption of successful safety practices like BBS were the primary factors linked to this decrease (Marks et al., 2014; Hallowell & Gambatese, 2009). According to Krause et al. (1999), when BBS applications are done appropriately, they may reduce accidents and the expenditures that come with them by an average of 20-25% each year. Several researchers have investigated what motivates construction workers to engage in risky conduct, as this behavior has a direct bearing on the frequency with which harmful behaviors occur on job sites. Unsafe behavior among construction workers can be influenced by a multitude of factors. These include but are not limited to: age, gender, body mass index, smoking, alcohol consumption, education level, training, experience, health status, psychological factors, worker location, skill type, work environment, sleep habits, and sleep quality. Many industries, including mining and construction, have a habit of not following safety procedures diligently, not adhering to laws and regulations, and not taking measures against risks (such as wearing personal protective equipment), according to Clark (2006: 315-327). This is a representation of the reality in the Nigerian construction sector, where disregard for safety protocols is rampant in the pursuit of convenience, speed, and efficiency. Most construction managers prioritize production above safety, which is why this happens (Enshassi et al., 2009: 140). According to Gurmu (2019: 2), building projects have been delayed and expenses have gone up because accidents have reduced worker productivity. In order to prevent accidents from happening in the first place, Agumba et al., (2013: 70) argue for health and safety measures that are both effective and proactive, such as safety-leading indicators. According to H. W. Heinrich's research, it may be concluded that unsafe working circumstances account for just 10% of workplace accidents and occupational disorders, whereas workers' harmful conduct accounts for over 88% (Pęcilło, 2010). As a general rule, when people sustain injuries as a consequence of their actions, it's because such actions have never before caused harm. Some risky activities that have resulted in accidents may not fit neatly into the usual triangle, as shown graphically in Figure 2.2.

This problematic conduct is often site-specific and so intrinsic to the system (a common cause). What this suggests is that management systems have known about this risky conduct for a long time, watched it, and maybe even supported it indirectly. The harmful practices are deeply embedded in the current culture of the company. This is where incident investigations based on conduct get their start. Rather than revealing unique reasons, the answers to these queries tend to reveal more generalized ones. No additional rules, responses, or punishment are needed by these results. They need system upgrades, and when management takes care of these needs, the staff responds positively. Participation in incident investigations, rather than animosity and resistance, is the outcome of this strategy across geographies and sectors. The elimination of potential dangers is the greatest benefit to safety.

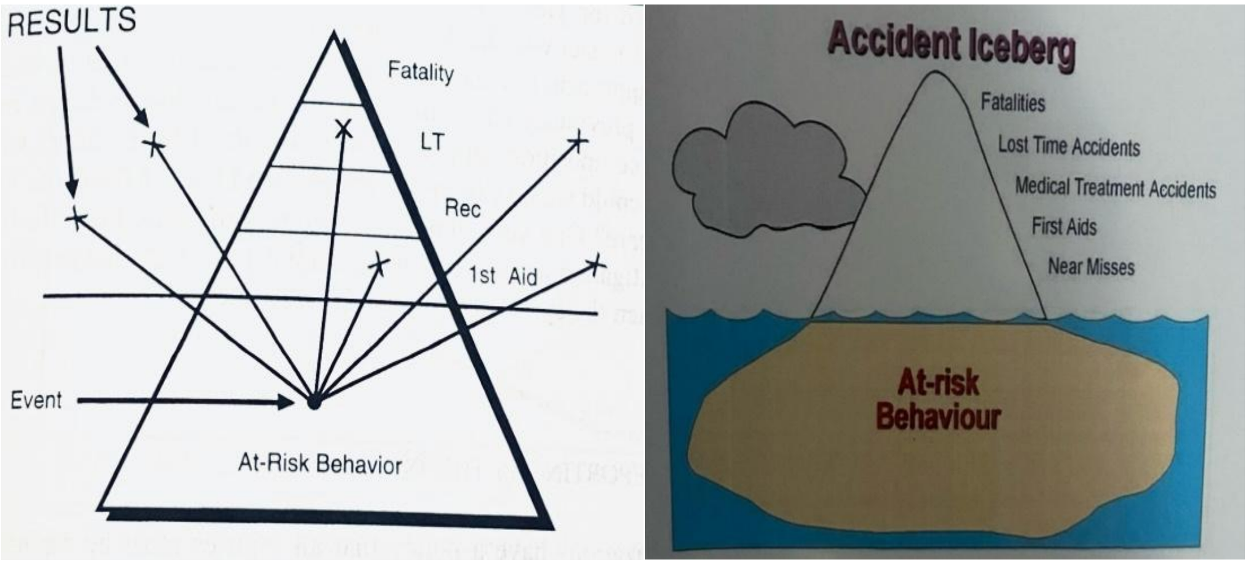

Figure 2.2 The Result of Some At-Risk Behaviors Fall "Within" the Accident Triangle, But Others Do Not. (Source: Bird & Loftus, 1976).

3. Material and Methods

3.1 Research Design

This study applied a cross-sectional descriptive design with the sole aim of getting detailed responses as regards identifying the root causes of incidents in the context of construction companies in Port Harcourt and evaluating the effectiveness of BBS by establishing its relationship with incident prevention.

3.2 Study Area

The study was carried out in construction firms within Port Harcourt LGA and Obio Akpor LGA of Rivers State. Port Harcourt LGA area is situated 52 kilometers southwest of Ahaoda and about 40 kilometers Northwest of Bori. It is bounded to the south by Okrika, to the east by Eleme, to the north by Obio Akpor, and to the west by Degema. It has a total land size of 109 square kilometers.

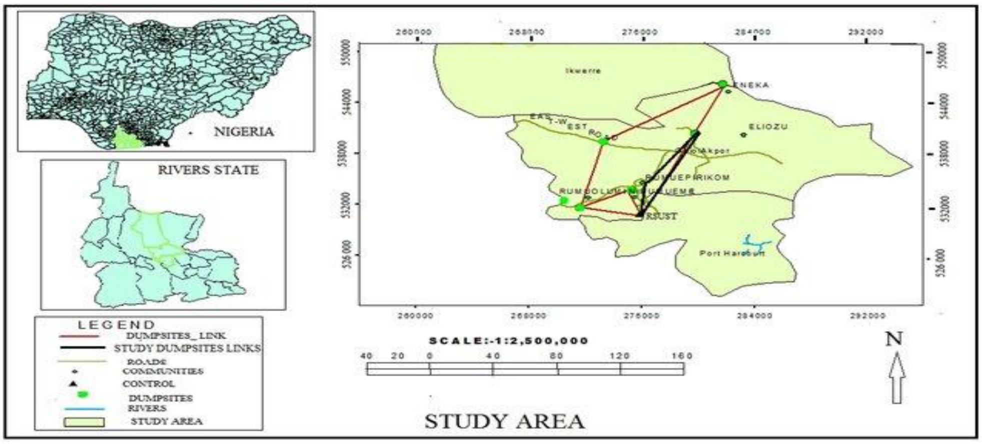

Fig. 3.1: Map of Obio/Akpor and Port Harcourt local Government area showing the study area. ***Source: Agbemuko et al., 2017***

3.3 Population of the Study

The target population for this study included the registered construction firms that have either head offices or branch offices in Port Harcourt Nigeria. Small (70 employees) and medium-sized (472 employees) construction firms that are registered with the Federation of Construction Industry (FOCI) in Nigeria and that were, at the time of the study, engaged in an ongoing construction project were considered for the study as the population size (542).

3.4 Sample and Sampling Technique

The sampling technique used in the study was non probability sampling technique called convenience sampling. This method was chosen because it gave room for gathering the data quickly and it involved selecting participants for a study based on who is convenient and willing to participate in the selected company.

3.4.1 Sample Size Calculation

The sample size for this study is 230 calculated using Slovene's formula for sample size thus:

$$n = \frac{N}{1+Ne^2} \quad (3.1)$$

Where: n = sample size, N = Population, e = marginal error. Using the formula above in putting the estimated population size of 542 from two different scales of construction companies, the sample size is calculated to be 230 at 5% level of confidence.

3.5 Instrument for Data Collection

Questionnaire was used as an instrument for data collection. The instrument (questionnaire) formulated was titled "Evaluation of Behavior-Based Safety as an Incident Prevention Tools in Selected Construction

Companies in Port-Harcourt". The questionnaire consisted of two sections. Section A consists of personal data and section B consists of specific questions for the research works. Section B will later be divided into four (4) part, each part will be structured based on the Research Question. The study instrument took the four (4) points rating Likert scale format. The response levels were strongly agreed (SA), Agreed (A), Disagreed (D) and strongly disagreed (SD). Every positively structured item is to be scored as SA 4, A 3, D 2 & SD 1 while the negatively structured items were scored reversely as SA 1, A 2, D 3 & SD 4.

3.6 Nature and Sources of Data
For this study to be carried out and the objectives achieved, relevant secondary data were used such as literature from textbooks, google search engine, journals, and previous research work from the university library. The study also applied a primary data collection tool (structured questionnaire).

3.7 Method of Data Collection
A mixed-method research design approach was adopted. This method combined the quantitative and qualitative approaches for data collection and analysis. Conducting surveys or collecting numerical data helped to quantify the frequency and severity of incidents, identify patterns, and establish correlations between BBS observation and incident prevention. This method allowed for statistical analysis and generalizability of findings to a larger population. Utilizing qualitative methods such as document reviews, and observations helped provide in-depth insights into the specific root causes of incidents and the contextual factors that contribute to them. This approach allowed the researcher to explore individual experiences, perceptions and behaviors which may not be captured by quantitative data alone. The researcher generated the questionnaire in an online google form and was sent online to selected small and medium-sized workers in construction companies and the answers were retrieved at convenience.

3.8 Methods of Data Analysis
Data analysis was done using the Scientific Package for Social Sciences (SPSS) version 26.0 software, Excel statistics and results presented in tables and graphs. Descriptive statistics such as frequency distribution and percentages will be used to analyze the respondent demographic data.

3. Results and Discussions
4.1 Results
A total of 230 questionnaires were expected and a total of 199 were gotten which represents 86.5% response rate. The study evaluated the effectiveness of behavior-based safety as an incident prevention tools in selected construction companies in Port-Harcourt. The demographic characteristics of the participants are presented in Table 4.1 which shows the age range, Gender, Level of education, occupation, and years of working experience of the respondents.

4.1.1 Demographic characteristics of the respondents
Table 4.1 presents a summary of the demographic characteristics of the respondents. The result shows that the majority of the gender in the companies were male about 78.4%. this could be as a result of job duties, workplace conditions, or personal risk-taking behaviors. Also, it might be as a result of the job being physically demanding or dangerous jobs which therefore requires males than females. Experience is crucial when it comes to safety issues, in general. A highest proportion (33.2%) of the respondents had 6 – 10 years of work

experience in the companies, indicating their capability to provide well-informed responses while the lowest years of working experience is more than 15 years with about 14.1%. It was also observed that the highest level of education was a bachelor's degree (46.2%), this shows that people with higher levels of education are more aware of the importance of safety and are more likely to participate in behavioral-based study and every safety related activity thereby tend to have lower rates of incidents in the workplace. This is likely due to several factors, including a better understanding of safety procedures, higher levels of job satisfaction, and access to better safety training and equipment. Also, the high percentage (37.2%) may be because this age group is often considered the 'prime working age' and they are more likely to be involved in safety-related tasks and initiatives.

Table 4.1: Demographic characteristics of the Respondents.

Variable	Attribute	Frequency	Percentage (%)
Age Range	18 – 24 years	12	6.0
	25 - 34 years	74	37.2
	35 – 44 years	72	36.2
	45 – 54 years	32	16.1
	55 or above	29	14.5
Gender	Male	156	78.4
	Female	42	21.1
	Prefer not to say	1	0.5
Level of Education	Primary	1	0.5
	Secondary	40	20.1
	Diploma or Certificate	49	24.6
	Bachelor's Degree	92	46.2
	Master's Degree or higher	17	8.5
Occupation	Manager	20	10.1
	Engineer	62	31.2
	Technician	72	36.2
	Operators	14	7.0
	Labourer	4	2.0
	Other	27	13.6
Years of Working experience	Less than 1 year	24	12.1
	1 – 5 years	56	28.1
	6 – 10 years	66	33.2
	11 – 15 years	25	12.6
	More than 15 years	28	14.1

4.1.2 the predominant root causes of incidents within the selected construction companies in Port Harcourt metropolis

Table 4.2 indicates the root causes of incidents among selected construction companies in Port Harcourt. There were about seven responses with a high perception of the root causes of incidents. The mean value of these responses was above the mean average (3.40). Some of the root causes of incidents with high perception from the respondents include Lack of awareness or knowledge of safety rules or hazards, Lack of enforcement or discipline for safety violations, Lack of skill or competence in performing the task, Lack of attention or concentration due to distraction or stress, Lack of contingency or emergency plan for dealing with environmental incidents was also part of the root causes of incidents.

Some of these root causes can be mitigated by providing regular safety training and information sessions for employees, ensuring that all employees are aware of the safety rules and procedures in place, establishing clear consequences for not following safety rules and procedures, and ensuring that all employees are aware of these consequences, ensuring that all employees have the appropriate personal protective equipment (PPE) to minimize distractions, establishing a distraction-free work environment and encouraging employees to take regular breaks to maintain focus and concentration. The mean of some of the responses was found to be below the mean average which indicates that a few respondents didn't agree with the listed root cause but the majority of the respondents agreed. Lack of motivation or incentive to follow safety rules or procedures, Lack of resources or support for safety improvement, Lack of feedback or evaluation for improving performance, and Lack of control or mitigation of environmental hazards were some of the listed root causes with their mean (3.11 – 3.36) below the mean average (3.40). some of the ways to mitigate these causes include communicating the benefits of following safety rules, providing rewards or recognition for following safety rules and engaging employees in the development of safety policies, providing adequate funding and support for safety initiatives, ensuring that safety is a priority for the organization and engaging employees in the identification and resolution of safety issues, regularly evaluating safety performances, providing feedback on areas for improvement and identifying and addressing any gaps in safety knowledge, ensuring that all equipment and machinery is properly maintained and inspected.

Table 4.2: Identifying the root causes of incidents among selected construction companies in Port-Harcourt

S/N	Questionnaire Items	SA (%)	A (%)	D (%)	SD (%)	Mean	σ	Decision
1	Lack of awareness or knowledge of safety rules or hazards	117(58.8)	79(39.7)	3(1.5)		3.57	0.526	High Perception
2	Lack of motivation or incentive to follow safety rules or procedures	71(35.7)	110(55.3)	13(6.5)	5(2.5)	3.24	0.683	Low Perception
3	Lack of enforcement or discipline for safety violations	106(53.3)	88(44.2)	3(1.5)		3.52	0.530	High Perception
4	Lack of resources or support for safety improvement	97(48.7)	84(42.2)	11(5.5)	7(3.5)	3.36	0.745	Low Perception
5	Lack of skill or competence in performing the task	105(52.8)	88(44.2)	6(3.0)		3.50	0.558	High Perception
6	Lack of feedback or evaluation for improving performance	76(38.2)	103(51.8)	16(8.0)	4(2.0)	3.26	0.691	Low Perception
7	Lack of attention or concentration due to distraction or stress	109(54.8)	87(43.7)	3(1.5)		3.53	0.530	High Perception
8	Lack of skill or competence in performing the task	83(41.7)	113(56.8)	2(1.0)	1(0.5)	3.40	0.540	High Perception
9	Lack of assessment or monitoring of environmental conditions	104(52.3)	93(46.7)	2(1.0)		3.51	0.521	High Perception
10	Lack of control or mitigation of environmental hazards	58(29.1)	112(56.3)	21(10.6)	8(4.0)	3.11	0.741	Low Perception
11	Lack of adaptation or adjustment to environmental changes	92(46.2)	92(46.2)	10(5.0)	5(2.5)	3.36	0.696	Low Perception
12	Lack of contingency or emergency plan for dealing with environmental incidents	96(48.2)	100(50.3)	1(0.5)	2(1.0)	3.46	0.566	High Perception

Mean average = 3.39. Mean of responses above the mean average – High perception while mean of responses below the mean average – low perception

4.1.3 Effectiveness of BBS approach in identifying and correcting unsafe acts within the construction firms in Port-Harcourt.

Table 4.3 indicates the effectiveness of the BBS approach in identifying and correcting unsafe acts within the construction firms. Some of these BBS approaches can be said to be regular observations of employees' behavior and work practices to identify any unsafe behaviors or actions, providing feedback to employees about any unsafe behaviors and actions that were observed, developing and implementing corrective actions to address any unsafe behaviors or actions that were identified, regularly evaluating and improving the effectiveness of the BBS approach. Three of the responses had a high perception (mean = 3.41 – 3.47) on the analysis of the effectiveness of the BBS approach in identifying and correcting unsafe acts. They strongly believed that the reporting and analysis of unsafe acts through these BBS approaches would result in meaningful changes and improvements in safety procedures and practices, BBS approach would provide organizations with valuable data that can inform their safety strategies, these BBS approach would successfully modify employee behavior by reinforcing safe practices. Some of the responses had a slightly low perception (mean = 3.33 – 3.34) because some of the respondents disagreed with the approach although the majority of the respondents agreed with those responses. They believed that The BBS approach is highly effective in identifying unsafe acts within our construction firm, Unsafe acts identified through the BBS approach are always promptly addressed and corrected, and also that the BBS approach contributes significantly to a safer work environment by reducing unsafe acts. The disagreement by some of the respondents to the effectiveness of these BBS approaches might be because of some factors such as those respondents not being fully trained on the BBS approach or not understanding fully how it works, they may not have been fully committed to the BBS approach and may not have seen the benefits of it. These observations can be mitigated by communicating the benefits of the BBS approach and how it contributes to a safer environment, encouraging open communication and feedback about the BBS approach, engaging all employees in the BBS approach and making sure they understand how it works, etc. It can therefore be said that BBS is effective in identifying and correcting unsafe acts.

Table 4.3: Analyze the effectiveness of BBS approach in identifying and correcting unsafe acts within the construction firms in Port-Harcourt.

S/n	Questionnaire Items	SA (%)	A (%)	D (%)	SD (%)	Mean	σ	Decision
1	The BBS approach is highly effective in identifying unsafe acts within our construction firm	69(34.7)	127(63.8)	3(1.5)		3.33	0.503	Low Perception
2	Unsafe acts identified through the BBS approach are promptly addressed and corrected	79(39.7)	110(55.3)	8(4.0)	2(1.0)	3.34	0.605	Low Perception
3	The BBS approach contributes significantly to a safer work environment by reducing unsafe acts	69(34.7)	128(64.3)	2(1.0)		3.34	0.495	Low Perception
4	The reporting and analysis of unsafe acts through BBS results in meaningful changes and improvements in safety procedures and practices	87(43.7)	108(54.3)	3(1.5)	1(0.5)	3.41	0.551	High Perception
5	BBS provides organizations with valuable data that can inform their safety strategies.	88(44.2)	109(54.8)	2(1.0)		3.43	0.517	High Perception
6	BBS successfully modifies employee behavior by reinforcing safe practices.	99(49.7)	96(48.2)	3(1.5)	1(0.5)	3.47	0.558	High Perception

Mean average = 3.39. Mean of responses above the mean average – High perception while mean of responses below the mean average – low perception

The relationship between BBS and incident prevention within the construction firms in Port-Harcourt.
The correlation between behavior-based safety approach and incident prevention is seen in Table 4.4. There is a strong and positive association between BBS and incident prevention, as seen by the correlation coefficient in the table above. A relatively strong positive link is shown by the correlation coefficient of 0.602, which is statistically significant at p 0.000<0.01. This suggests that the incidence of incidents decreases as BBS rises. According to the results, there are some practices and behaviors identified by the BBS method that might significantly influence incident prevention, as shown by the relatively strong positive association. Methodically collecting and analyzing data on safety behaviors and observations, training and education, employee participation, safety equipment and resources, workload and time pressure, and enhancing safety based on BBS findings are all components of this particular activity. There is a high probability that incidents will rise in the organizations unless these practices are implemented. Employees who have not received enough knowledge and training may be oblivious to safety protocols and may fail to recognize the reasons of accidents, which may worsen the situation. Because of this, it is clear that problems might occur in the workplace when the BBS method is reduced.

Table 4.4: Table evaluating the nexus between BBS and incident prevention

Correlations			
		Incident Prevention	**Behavioural-Based Safety Approach**
Pearson Correlation	Incident Prevention	1.000	.602
	Behavioural-Based Safety Approach	.602	1.000
Sig. (1-tailed)	Incident Prevention	.000	.000
	Behavioural-Based Safety Approach	.000	.000.
N	Incident Prevention	199	199
	Behavioural-Based Safety Approach	199	199

*** Correlation is significant at the 0.01 level (2-tailed)*
Source: Research Data, 2024 (SPSS output, version 23.0)

4.2 Discussion of Findings
The study evaluated BBS as an incident prevention tools in selected construction companies in Port Harcourt. Table 4.2 indicated that Lack of awareness or knowledge of safety rules or hazards had the highest mean of 3.57±0.526 which could be a result of the lack of training on safety rules and hazards, poor communication of safety information, inadequate signals or warnings, poor designs of work processes or work areas. It is worthy of note that failure to understand safety and work processes can render all other processes ineffective which is in line with the study of Myers et al. (2010). There were several other root causes of incidents and these causes can be mitigated by paying close attention to necessary details on safety.
This study in Table 4.3 established that the BBS approach has been effective in identifying and correcting unsafe acts within the construction firms in Port Harcourt. There were positive responses from the respondents as the majority of them agreed to this effect. The behavior-based approach to dealing with occupational safety

and health (OSH) issues, which is recognized as behavior-based safety (BBS), is known to be effective in reducing accidents that cause harm, and incidents which do not cause harm but have the potential to. The research also agrees that BBS management has been shown to be effective at increasing employee participation and reducing incidents in a wide variety of organizations, including on college campuses, manufacturing plants, paper mills, oil refineries, construction sites, and coal mines. The gaps between BBS approach and incident prevention were also established. It was observed that some that did not agree with the effectiveness of the BBS approach might have been because of some factors like not being trained on BBS approach or not understanding fully how it works, and they may not have been fully committed to the BBS approach and may not have seen the benefits of it.

The study was also able to establish the relationship the BBS and incident prevention. The result of the research shown in Table 4.4` indicates that there is a positive and moderately strong relationship between BBS and incident prevention. The correlation coefficient of 0.602 indicates a moderately strong positive relationship and it is significant at p 0.000<0.01. Therefore, continuous improvement in the BBS approach will lead to a great reduction of incidents in construction companies. This suggests that the tendency of occurrence of incidents decreases as BBS rises. Results also reveals that there are some practices and behaviors identified by the BBS approach that might significantly influence incident prevention, as shown by the relatively strong positive association. This also indicates that when less attention is paid to the BBS approach, it will lead to greater incident occurrence in construction companies.

5. Conclusion

From the above research, it was observed that there are several root causes of incidents in selected companies and the different ways that these root causes can be mitigated were stated as well. Organizations can create a safer and more productive workplace for all by Investing in training, safety procedures, and equipment maintenance. BBS has been shown to be an effective approach for identifying and correcting unsafe acts in the workplace. It focuses on the underlying causes of unsafe behavior rather than simply addressing the consequences of unsafe behavior. It is safe to say that by addressing the root cause of unsafe behavior, organizations can create a culture of safety that reduces the risk of incidents.

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