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Human Factors and Errors Contributing to Accidents in Oil Rig Platforms in Nigeria Maritime Industry

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ABSTRACT :

This study investigated the relationship between human factors and errors contributing to accident in oil rig platform in Nigeria maritime industry. The study was anchored on social safety theory, accident causation theory, domino theory and Swiss cheese model. The study adopted primary data collection method and used well-structured questionnaire distributed to oil rig workers and companies in the Niger Delta areas of Port Harcourt and Warri to elicit primary data. The study categorized human factors into individual, group and organizational factors; and human errors into skilled-based, rule-based, and knowledge-based errors. It was found that a significant positive relationship exists at 95% confidence level between individual factors with skill-based, rule-based and knowledge-based errors at r = 0.664, 0.594, and 0.436 respectively. It was found that a significant positive relationship exists at 95% confidence level between group factors with skill-based, rule-based and knowledge-based errors at r = 0.786, 0.587 and 0.887 respectively and also a significant positive relationship exists at 95% confidence level between organizational factors with skill-based, rule-based and knowledge-based errors at r = 0.805, 0.485 and 0.732 respectively. The study concluded that human factors give rise to errors that contribute to accidents in oil rig platforms. The study therefore, recommended frequent training and retraining of personnel, routine checks and organization should ensure well formulated approach and defined routine work and that oil terminal companies and the maritime industry must focus training on specific issues which may include group performance duties and responses.

Keywords: Human Factors, Human Errors, Accidents, Knowledge-Based Error, Skill- Based Error, Rule-Based Error

Introduction

Nigeria offshore maritime industry has developed over the years especially in the area of oil and gas industry since 1973 crude oil discovery and oil and gas exploration of the upstream industry. Concerns have been expressed in the maritime and engineering industry particularly in the oil and gas industry that a declining standard of health, safety management, and quality assurance has contributed significantly to an increase in problems relating to workplace hazards and accidents (Zakaria *et al*., 2012).

Every year lives are lost and billions of naira worth of damages are incurred due to accidents such as explosions on oil rigs, oil spills, slip and fall and many other forms of accidents resulting to loss of lives and properties. There are many factors considered contributing to industrial accidents which human error is one of the most considered factors. It is often a single careless act that endangers the work process.

Despite the advances on accident preventions technologies that have been made in general ships design, tanker vessel operations, fire prevention systems, fire fighting technology, and oil rig accident precautionary and safety measures; shipboard accidents have remained a very real threat to the maritime industry globally. Accidents involving fires/explosions rank second in oil rigs that result to serious maritime casualties. A survey of total loss accidents in 1500 oil tankers over 25 years, 1971 to 1996, showed that these can be arranged in the following order: stranding, fire, water leaks, gales, and collisions (Guillermo, 2000). The enormous amount of hazardous and flammable materials handled in an oil rig platform or transported by water raises concerns not only for the safety of the rig and vessel's crew but also for the protection of the surrounding environment against catastrophic spills and pollution (Guillermo, 2000).

According to Talley *et al.* (2005). It is important to regulate human actions aboard an oil rig platform or vessel because: Most oil rig and marine vessel accidents are caused by human error; Oil rig accident claims are often attributed to human error; and it is less expensive to change human behaviour than it is to redesign vessels for safety (Talley *et al.,* 2005).

In Nigeria's context, data are scarce on the relationship between safety culture, human behaviour, and safety performance, consequently, there exists a possibility for policy makers in this all-important industry to make suboptimal decisions where sufficient empirical conclusions and conceptual models are unavailable to guide proper decision making. Hence, this study examines the behavioural components of oil rig safety to determine the human factors responsible for oil rig and marine accidents in Nigeria.

Objectives of the Study

This study analyses the relationships between human factors and errors contributing to accidents in the maritime oil rig platforms in Nigeria. The objectives of the study are as follows:

I. To determine the relationship between individual factors and skill-based error in maritime oil rigs in Nigeria
II. To determine the relationship between individual factors and rule-based error in maritime oil rigs in Nigeria
III. To determine the relationship between individual factors and knowledge-based error in maritime oil rigs in Nigeria
IV. To determine the relationship between group factors and skill-based error in maritime oil rigs in Nigeria
V. To determine the relationship between group factors and rule-based error in maritime oil rigs in Nigeria
VI. To determine the relationship between group factors and knowledge-based error in maritime oil rigs in Nigeria

Research Questions

I. Is there any significant relationship between individual factors and skill-based error in maritime oil rigs in Nigeria?
II. Is there any significant relationship between individual factors and rule-based error in maritime oil rigs in Nigeria?
III. Is there any significant relationship between individual factors and knowledge-based error in maritime oil rigs in Nigeria?
IV. Is there any significant relationship between group factors and skill-based error in maritime oil rigs in Nigeria?
V. Is there any significant relationship between group factors and rule-based error in maritime oil rigs in Nigeria?
VI. Is there any significant relationship between group factors and knowledge-based error in maritime oil rigs in Nigeria?

Research Hypotheses

- H_{o1}: there is no significant relationship between individual factors and skill-based error in maritime oil rigs in Nigeria.
- H_{o2}: there is no significant relationship between individual factors and rule-based error in maritime oil rigs in Nigeria.
- H_{o3}: there is no significant relationship between individual factors and knowledge-based error in maritime oil rigs in Nigeria.
- H_{o4}: there is no significant relationship between group factors and skill-based error in maritime oil rigs in Nigeria.
- H_{o5}: there is no significant relationship between group factors and rule-based error in maritime oil rigs in Nigeria.
- H_{o6}: there is no significant relationship between group factors and knowledge-based error in maritime oil rigs in Nigeria.

LITERATURE REVIEW

The review of the literature looks into some basic theories and concepts supporting the study and/or on which the study is founded. The review of the literatures also considers the conceptual review which deals on the ideology of the researcher looking at the definition and explanations of those basic terms forming the topic and variables to be studied based on research design. Empirical review is also quite necessary which observes other research works by various authors on the related study.

Theoretical Review

This study is anchored on social safety theory and accident causation theory.

Social Safety Theory

Social Safety Theory aims to account for how and why specific types of positive and negative social experiences are strongly related to human health and behavior (Slavich, 2022). The theory was developed to help advance classic thinking on this topic, which has persisted until today and driven an overly general, sometimes misguided approach to investigating the specific types of experiences hypothesized to be most strongly associated with health-related outcomes. In the case of adverse life experiences, for example, Selye (1976) argued that stress is 'the nonspecific response of the body to any demand' (p. 74) and that a stressor is 'that which produces stress' (p. 78). Guided by this nonspecific view of life stressors and stress physiology, most studies conducted today still use stressor exposure metrics that boil a person's myriad of stressful experiences down to one total score that completely ignores the specific stressors that occurred and when exactly they happened, thus precluding an examination of whether some stressors are more predictive than others (Monroe & Slavich, 2020; Slavich, 2016, 2019).

Social Safety Theory hypothesizes that maximizing social safety and minimizing social threat made humans exquisitely sensitive to social information and created a deep motivation to foster, maintain, and restore social safety whenever possible. Positive social safety schemas provide individuals with a favorable sense of the self, social world, and future that promotes a stable feeling of social connection, affiliation, inclusion, and belonging. In contrast, negative social safety schemas give rise to thoughts and feelings about the self, social world, and future that can oscillate or change in response to varying social feedback and circumstances (Kawai & Akira, 2006). Indeed, disturbances in one's social safety schemas may be key to understanding abnormal cognitive, emotional, and behavioral patterns that are central to a variety of different psychiatric disorders (Irwin, 2017).

Social safety also benefits behaviour. For example, in addition to predicting more positive health behaviours across the lifespan, social safety is associated with greater perseverance, productivity, and achievement at work and school, in addition to more volunteering and fewer sick days (Slavich, 2020). Fostering and maintaining social safety thus confers several notable benefits to human health, wellbeing, longevity, and behaviour.

Accident causation Theory

Accidents occur every day and, one way or another, will impact virtually everyone. During the year 2012, there were more than 2.8 million on-the-job nonfatal injuries in the United States (Bureau of Labor Statistics, 2013). That same year, there were also 4,628 on-the-job fatalities (Bureau of Labor Statistics, 2014). Note that other incidents, such as workplace violence, add to this data as well, though a vast majority are related to accidents. Further highlighting the impact of accidents is the costs absorbed by organizations. Cost considerations include workers' compensation case management, the use of paid-time-off/sick time, short- and/or long-term disability, worker replacement costs (i.e. training of an employee to replace the injured worker), and time and money spent investigating the accident with follow up corrective actions which can include policy and/or equipment change or upgrades.

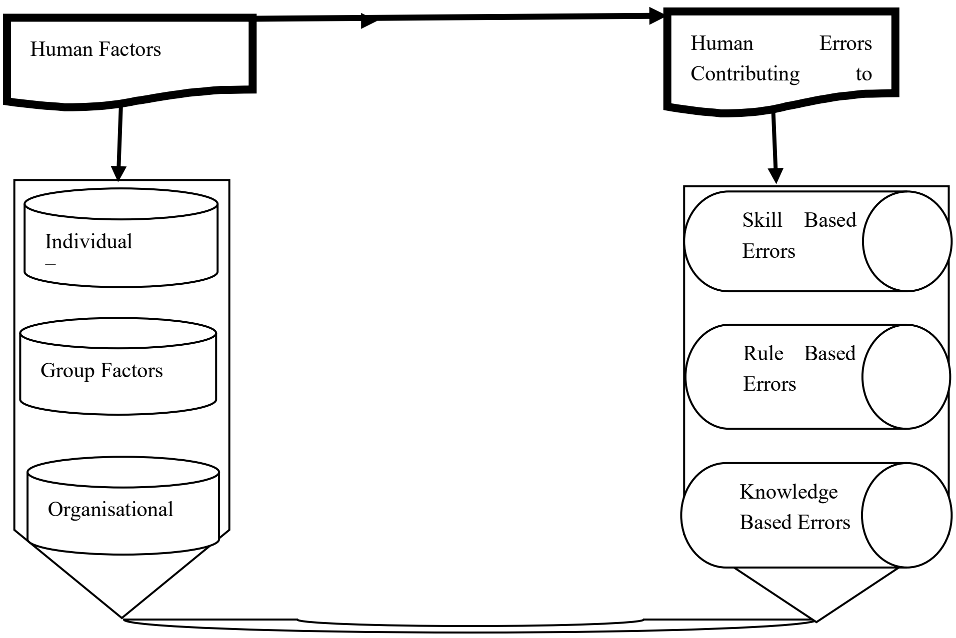
Even further expanding upon the impact of accidents is the great number of accidents that do not result in injuries. In an early study of accidents, Heinrich (1950) found that for every serious injury, there were 29 minor injuries and 300 accidents resulting in close calls. At that rate, even assuming that all injuries (major or otherwise) are included in the official statistics, there would be an additional 42 million accidents that go unreported. Figure 1 demonstrates Heinrich's (1950, p. 24) "Foundation of a Major Injury," sometimes also referred to as the Injury Pyramid.

Figure 1: Foundation of a Major Injury

An accident is an undesired event that results in personal injury or property damage. This definition implies two important points. First, accidents are unavoidable; the chance of one occurring will virtually always be present. Second, the chance of an accident occurring is a variable that can be changed. While it is impossible to prevent *all* accidents, it is possible to decrease their rate of occurrence. Understanding the cause of such phenomenon is key to decreasing the rate at which accidents occur. Determining the true root cause of each accident is the *only* way to formulate effective prevention strategies. Presented below are a few of the most common theories used to explain accidents. As with theories discussed in other chapters, these are not perfect and will not explain every accident in full detail. Rather, they provide a nomothetic explanation that seeks to explain what usually happens and attempts to address the most common underlying causes.

Conceptual Review

Figure 2: Conceptual Framework of the Relationship between Human Factors and Errors Contributing to Accident in Oil Rig in Nigeria Maritime Industry



Source: Results of the Final Research Work, 2025, and SPSS 26.0 Outputs, 2025

Human Factors

Human factors and Human errors are most times interchangeably used. However, Human factors and Human errors can be studied separately and if any relationship between them is overlooked, this might be due to no agreement between them on precise nature and definition (Patterson & Shappell, 2010).

In the offshore industry, we often used the terms 'Human Factors' and 'Human Errors' without the proper understanding of the meaning of the terms. They were just used as general terms referring to a cause of accidents which occurred due to people other than technical faults. Traditionally Human Factors were defined as the scientific study of human and machine interactions (Patterson & Shappell, 2010; Yashoda, 2021). In recent years the definition of these terms was extended to encompass the effects on safety by an individual, group, or organizational as human factors and human factors when resulting to accidents (Yashoda, 2021).

In general, Human factors are defined as the interaction between humans, equipment, and the management systems or organizations (IOGP, 2005).
NOPSEMA (2016), defined human factors into three basic categories, similar to (Gordon 2018) as follows:

i. Organizational factors – include the culture of the company, communication systems, decision-making strategy, organizational priorities, and knowledge-based errors of resources, leadership behaviour, change management, and relevant key performance indicators (KPI).
ii. Job factors - Includes human-machine interface, physical working environment, knowledge-based errors and quality of procedures, workload, task requirements, equipment used, and team member's behaviour.
iii. Individual factors – include personality, attitude, mood, mental ability, competence and skill, and individual health factors such as fatigue, alcohol and drugs, physical capability, and psychological health.

Human Errors Contributing to Accident

Human error refers to something having been done that was "not intended by the actor; not desired by a set of rules or an external observer; or that led the task or system outside its acceptable limits". In short, it is a deviation from intention, expectation or desirability.
Human error is an action that has been done but that was "not intended by the actor; not desired by a set of rules or an external observer; or that led the task or system outside its acceptable limits".[1] Human error has been cited as a primary cause and contributing factor in disasters and accidents in industries as diverse as nuclear power (e.g., the Three Mile Island accident), aviation, space exploration (e.g., the Space Shuttle Challenger disaster and Space Shuttle Columbia disaster), and medicine. Prevention of human error is generally seen as a major contributor to reliability and safety of (complex) systems. Human error is one of the many contributing causes of risk events.

Design deficiencies or lack of interface between the people and the technology reduces human performance. These factors are often referred to as "design induced human error". It is more important for an organization to include human factors during the design process to ensure easy accessibility and suitability for local work conditions. The oil and gas industry have to improve lots in the field of human factors engineering design by learning from industries like aviation, defence, and nuclear power (Nordlöf *et al*., 2015). Oil and gas industries are continuously working on developing standards and processes to customize their needs. Some of the design errors are as shown:

Plate 1`: Difficulties Inaccessibility

Source: (IOGP, 2011)

The design followed the international standards but failed to consider local workforce.

The Trinity Spirit, a Floating Production, Storage and Offloading (FPSO) vessel exploded just off the coast of Nigeria and sunk in February 2022. Five workers were killed and two others who were never recovered were presumed dead. The 46-year-old vessel was in a state of near-total disrepair, highlighting the issue of poor maintenance of the facility.

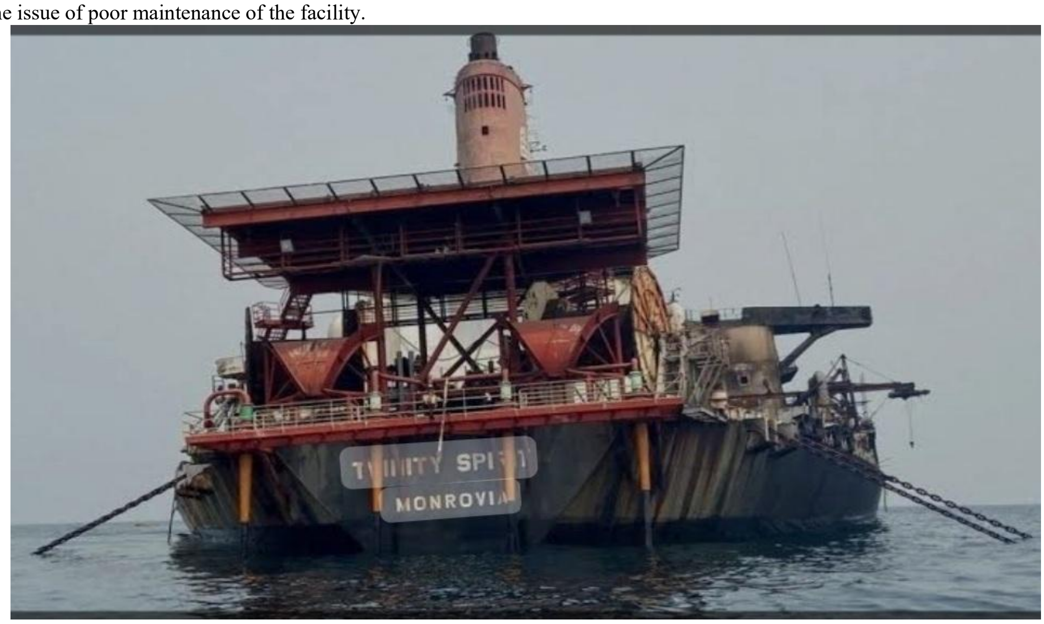


Plate 2: FPSO Trinity Spirit (in a poor maintenance state – days before explosion)

Source: (Bolaji John, 2023)

Plate 3: FPSO Trinity Spirit (after explosion)

Source: (Bolaji John, 2023)

Empirical Review

Human Factors and Error in Accident Occurrence

According to **Broadbent *et al*. (2021) study on cognitive failures indicating that cognitive failures are reasons for accident occurrence following human factors and errors.** The aim of the Cognitive Failures Questionnaire (CFQ) is to measure self-reported failures in perception, memory, and motor function (**Broadbent *et al*., 2021)**. The scale was presented to 240 electrical workers in the United States Army. The CFQ predicted both car accidents and work accidents. When the foremen were asked to assess the workplace safety performance of 158 workers, the assessments of foremen and employees corresponded very well to each other's (Wallace & Vodanovich, 2013).

Wallace and Chen (2015) developed the Workplace Cognitive Failure Scale with 22 items like "Cannot remember whether or not you have turned off work equipment?" Using this scale, the researchers showed that general cognitive failure predicted unsafe behaviours and micro-accidents of American workers. Later with a smaller sample the same scale predicted supervisor safety ratings, injuries and missed workdays.

Stojiljkovic *et al.* (2012) examined the tips-of-tongue phenomenon by analysing diaries, which volunteers kept for four weeks. The volunteers wrote down 75 tips of tongue experiences, which was an average of 2.5 tips per diarist. There were no gender differences in experiencing tips-of-the-tongue state. The object of the tip-of-the-tongue was a familiar person for the speaker in one out of three cases.

These studies revealed different methods to measure cognitive failures even for everyday situations. They also indicated that cognitive failures and processes were related to injuries and human errors.

Relationship between Human Factors and Errors Resulting in Industrial Accident

Rasmussen (2018) examined the human errors that are as results of human factors. The analysis was based on Rasmussen's SRK (Skill – Rule – Knowledge) model:

1. Skill-based behaviour represents sensor motor performance automatically without conscious control. Work performance is based on subroutines which are subject to higher level control.
2. Rule-based behaviour happens in a familiar work situation, where a consciously controlled stored rule is applied. Performance is goal-oriented, but structured by feed-forward control through a stored rule.
3. Knowledge-based behaviour happens in unfamiliar situations, where a goal is explicitly formulated, based on an analysis of the environment and the overall aims of the person. The means must be found and selected according to the requirements of the situation.

In a study of British drivers, errors were defined as the failure of planned actions to achieve their intended consequences. Women drivers were more prone to harmless lapses, whereas male drivers reported more violations. The number of violations declined with age, but the number of errors did not decrease.

In the Serbian electric power company, human errors were analysed by Absolute Probability Judgement. This assumes that people can directly assess their likelihood in the case of human error. Human errors with the highest probability of happening were failure to use prescribed tools and absence of job authorization (Stojiljkovic et al., 2012). In the analysis of 500 reported pipe work incidents at a British chemical plant, 41% of immediate causes of incidents were of human origin and 31% were operating errors (Stojiljkovic et al., 2012).

Hospitals are another work environment, where human errors can have fatal consequences. In the cardiology ward of a Japanese hospital 181 accidental and incidental events were reported during a six-month period. A total of 40 of the reported events were classified as skill-based errors, 52 as rule-based errors, and seven incidents were designated as knowledge-based errors. A total of 12 errors were life threatening (Narumi et al., 2019). Adverse drug events accounted for about 25% of human errors in hospitals (Spencer, 2010). Most of accidents were human errors made by the doctors and nurses, in fact only 3-5% of errors were due to equipment (Gaba, 2019).

Air traffic is one of the safety-critical industries, where the effect of human error has to be examined thoroughly. The majority of the commercial aviation accidents in the United States were due to the pilot error, of which over half were skill-based errors, over one third were decision errors, under one in every ten perceptual errors with final group being violations of regulations Shappell et al. (2007).

Aircraft mechanics in Australia reported 666 human errors. They spent 65% of their working time correcting skill-based errors, 32% were rule-based errors, and 3% as knowledge-based errors. Hobbs and Williamson (2002) assessed that the reporting skill-based errors was more reliable than reporting rule- and knowledge-based errors. Subsequently, they further examined a larger data set and revealed that only skill-based errors were related to occupational accidents. In addition, Hobbs and Williamson (2023) reported that memory lapses, rule violations and knowledge-based mistakes were the most commonly identified human errors made by aircraft mechanics.

Patterson and Shappell (2010) posit that skill-based errors were the most common unsafe act encountered in Australian mines, in which inadvertent or missed operations were the most general types of skill-based errors and these errors were typically the result of a breakdown in visual monitoring or the inadvertent activation of a control.

Organizational Factors behind Human Error

In a Japanese Train Company, drivers who made errors were required to participate in a mandatory training class. In order to avoid this "penalty" – a loss of face - the drivers did not report any mistakes. This practice led to over 100 fatalities in commuter train accidents (Patterson & Shappell, 2010**)**. Thus, this organizational measure to criminalize drivers who had made a human error (by forcing them to participate in the training class) resulted in even more fatalities. The review method consisting of 16 measures of organizational factors such as staff attitudes, departmental communication, carelessness and inadequate training etc., increase the risk of human error (Patterson & Shappell, 2010). The method helped identify latent failures made by top management and line management which led to human error and accidents.

To summarize, there are some organizational factors which can influence employees' behaviour so that they will make errors. Penalizing "human error" usually leads to hiding or denying that mistakes ever happened.

Human Error and Accidents Occurrence

In everyday life, it is generally believed that human errors can cause injuries. This is confirmed by empirical studies.

It is generally accepted that 80-90% of accidents are human error (Woods *et al*., 2010). For example, approximately 70% of aircraft accidents have been attributed to human factors (Reason, 2017). In a Finnish study, human errors were involved in 84% of serious accidents and in 94% of fatal accidents (Chikudate, 2009).

In a recent Mexican study, the safety experts documented 70 human factors causing hand injuries (Tabitha, 2022). These human errors were classified as personal factors, unsafe conditions, and organizational factors, respectively. The most frequent types classified as human error were improper handling of heavy objects, attempts to save time in conducting their operations, and the operator did not respect rules and procedures safety.

It is usually thought that errors are invariably negative, always to be avoided. The opposite approach is to conduct training that allows for the errors. When German typists were being taught to use computers, the subjects in the error-allowing-training group wrote fewer words and spent more time in correcting them than the subjects in the error-avoidance-training programme. However, the typists in the error allowing group dealt with a difficult task better than the control group (Reyes-Martinez, 2012). These studies reveal that human error makes a significant contribution to occupational injuries. Thus, prevention of human error is also one way to prevent occupational injuries.

Oil and Gas Industry Background

The Oil and Gas industry is an important part of the national and a backbone of the economy of most countries located in West Africa like Nigeria and other regions worldwide (Mitchell *et al*., 2012). It is divided into three major categories; upstream, midstream, and downstream. The upstream embodies exploration, development, drilling, and production of crude oil or natural gas; the midstream focuses on processing, refining and gathering crude oil and gas; while the downstream involves storing, distributing, logistics and transportation and marketing of petroleum products to domestic and industrial consumers. The oil and gas industry has grown rapidly over the past 40 years, and it is expected to grow more with strong demand (Mattia, 2013). Although the recent rapid development projects in this industry have provided a wealth of new jobs and a burst of economic vitality for various countries, these benefits are at a cost (Paraventi, 2014).

Human Error Specific Accidents in the Oil and Gas Industry

Different causes were identified in pieces of literature that focused on why an accident has occurred in the oil and gas industry as they are shown in Table 2.4. The most common contributor with over 70% of all oil and gas industry accidents is human error (Bhavsar *et al.*, 2015). Pitblado and Nelson (2013) and Mattia (2013) point out that the recent ongoing series of major accidents show that current safety management programs and improvements are not sufficiently effective in treating human elements appropriately in the oil and gas industry. However, Bhavsar *et al*. (2015) indicated that the cognitive challenges faced by operational workers during their interactions with the process and decision-making in this industry were behind this high rate. To sum up, Lawyers and Settlements (2011) argued that accidents in the oil and gas industry typically occur due to workers' carelessness or recklessness, workers postpone the equipment's maintenance or repair, and workers misunderstand. Various studies on causes of accidents in Oil and Gas (O&G) Industry can be summarized in the Table 2.4 below.

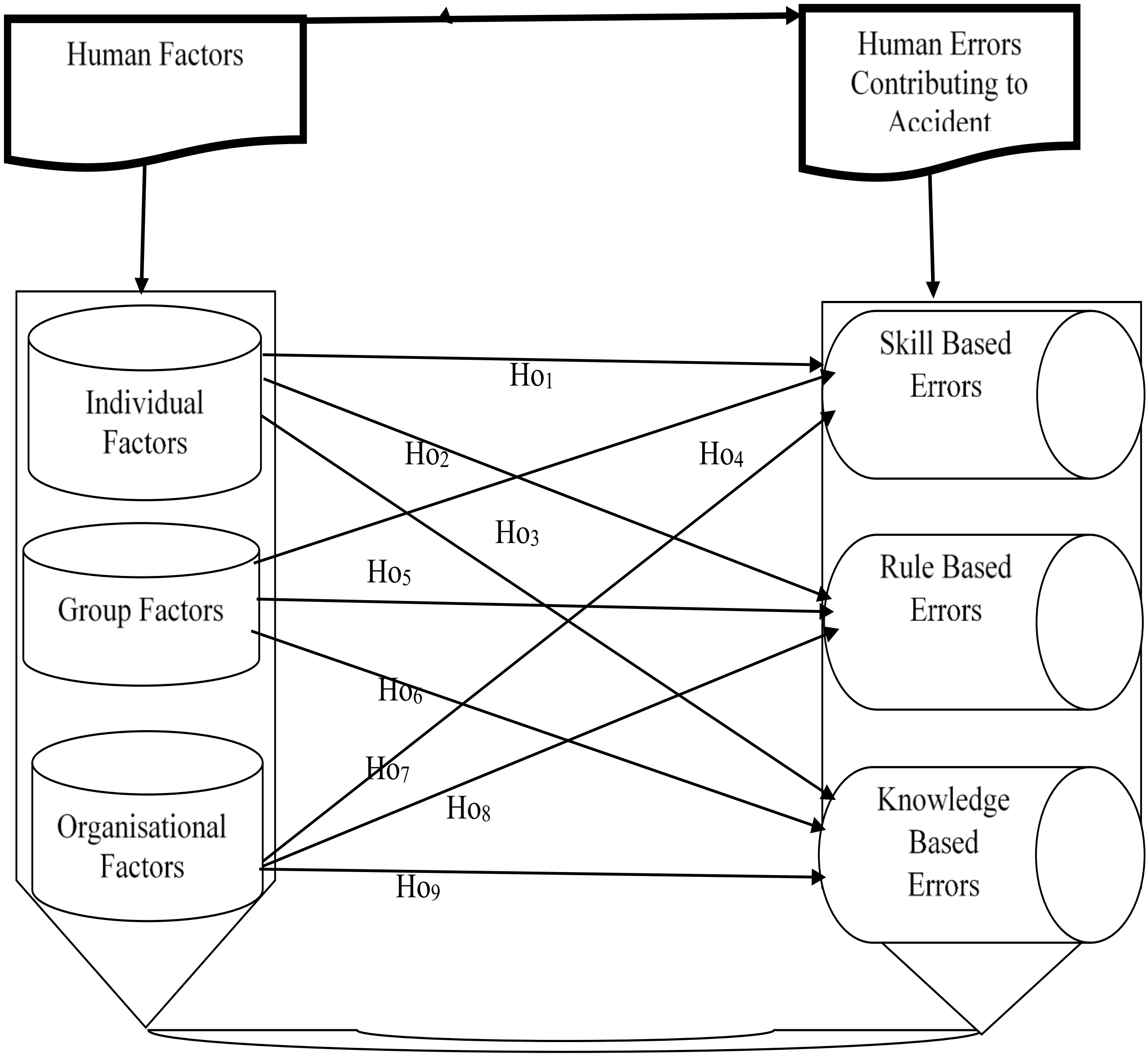


Figure 3: Operational Framework of the Relationship between Human Factors and Errors Contributing to Accident in Oil Rig in Nigeria Maritime Industry

Source: Results of the Final Research Work, 2025, and SPSS 26.0 Outputs, 2025

METHODOLOGY

Research Design

For the purpose of this study, cross sectional survey design was used for the study. The method is considered adequate and most appropriate because it helped the study to survey, examine, record, and interpret the variables that exist in this study. This study was conducted at Bonga field oil terminal, which is one of the biggest oil terminal/platforms in South-South Nigeria. The selection of the Bonga oil terminal for the study was deemed adequate having considered its characteristics as one of the busiest platforms in the South-South Nigeria and a core maritime industry.

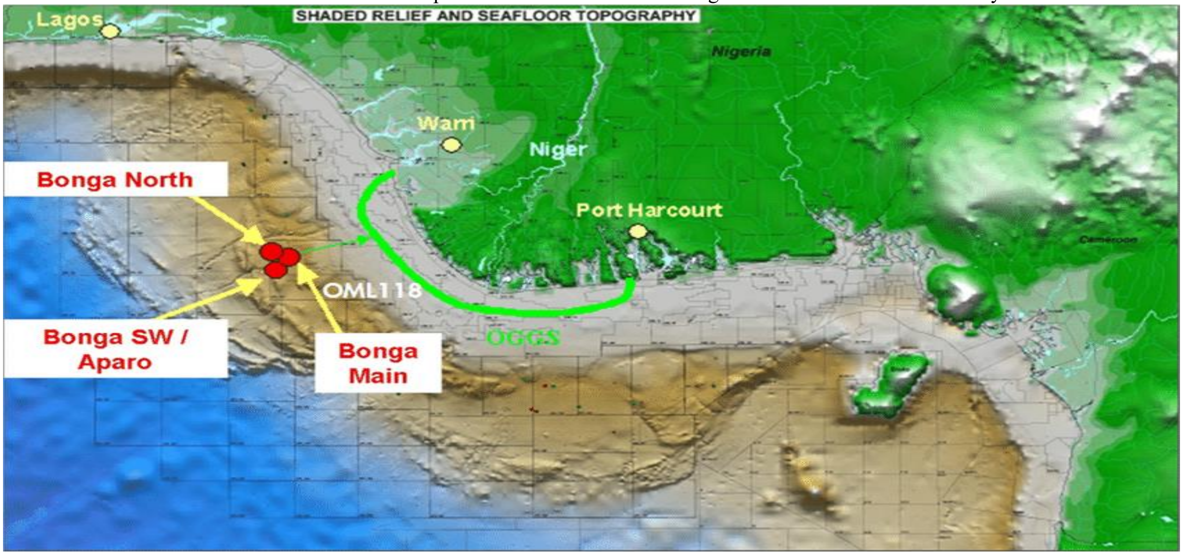


Plate 4: Bonga Field Overview

Source: (IOGP, 2011)

Plate 5: The Bonga FPSO

Source: (IOGP, 2011)

Population of the Study

The target population of the study include senior and junior staff of the selected organizations or firms working at the Bonga Oil field at the time this study was conducted. The total population was estimated at 1632 workers. See Table 3.1 below.

Table 3.1: Population of the Study

		Staff Categories		
S/No	**Names of companies**	**Senior Staff**	**Junior Staff**	**Total**
A	Bonga Field Oil Terminal	258	860	1118
B	Bonga Field Gas Terminal	134	380	514
	Total	392	1240	1632

Source: Field Survey (2025)

Sample Size Determination

To ensure that the sample is representative of each of the organisations in Nigeria, proportionate stratified random sampling was employed. This makes the proportion of the sample from each firm to conform to the pattern of the population and also increase accuracy of the study. Based on the above population, the sample size for this study was determined using Cochran's formula. This formula is used where the population size for the study is known. Thus, it is stated: Cochran sample size determination statistical formula for finite population was adopted in determining the sample size for the study. Thus, it is stated:

$$n = \frac{Z^2 NPq}{N_e^2 + Z^2 Pq} \quad (3.1)$$

Where: n = Sample size

N = Total Population

Z = Normal Distribution (Z = 1.96 for 95%) confidence p = Proportion of population likely to be included in the sample (50% or 0.5 is assumed)

q = Proportion of population not likely to be included in the sample (50% or 0.5 is assumed)

e = Margin of error (0.05) at 95% confidence level

$$n = \frac{1.96^2 * 1632 * 0.5 * 0.5}{1632 * 0.04^2 + 1.96^2 * 0.5 * 0.5} = \frac{267.32}{1.898} = 119.519$$

Therefore, the sample size (n) = 120

A stratified sampling method was adopted so as to give a fair representation to the designated organizations. The Bowley's proportional allocation formula was used and is given as:

$$n_h = \frac{nN_h}{N} \quad (3.2)$$

Where:

n_h= Number of units allocated to each firm/staff category.

N_h = Number of employees in each firm/staff stratum in the population n = Total sample size = 120

N = the total population size under study = 1632

Thus:

Bonga Field Oil Terminal

$$\frac{1118 \ x \ 120}{1632} = \mathbf{82}$$

Proportion of senior staff sampled = $\frac{258 \ x \ 120}{1632} = \mathbf{19}$

Proportion of junior staff sampled = $\frac{860 \ x \ 120}{1632} = \mathbf{63}$

Bonga Field Gas Terminal

$$\frac{514 \ x \ 120}{1632} = \mathbf{38}$$

Proportion of senior staff sampled = $\frac{134 \ x \ 120}{1632} = \mathbf{10}$

Proportion of junior staff sampled = $\frac{380 \, x \, 120}{1632}$ = **28**

Reliability of the Instrument

To ensure reliability of the instrument, test-retest method of reliability was applied. However, the reliability test was done through the use of pilot study. The test-retest was carried out using sixteen (16) copies of questionnaire prepared and administered to staff (respondents) of the selected organizations. After some days, (16) copies of the instrument were administered on the same respondents for the second time. The first and second sets of scores were correlated using Pearson correlation coefficient as the statistical tool, the result gave reliability index of 0.988 indicating a high degree of consistency.
The reliability was calculated as follows:

Table 3.2: Reliability Test

Source: Field Survey, (2023)

Items	First average X	Second average Y	Xr	Yr	D	d^2
1	2	2	1	1	0	0
2	2	2	1	1	0	0
3	2	1	1	1	0	0
4	1	2	1	2	1	1
5	1	2	2	2	0	0
6	2	2	2	2	0	0
7	1	1	2	2	0	0
8	1	1	2	2	0	0
						$\sum d^2 = 1$

$$R = 1 - \frac{6\sum d^2}{n(n^2-1)}$$

$$R = 1 - \frac{6 \, x \, 1}{8(8^2-1)}$$

$$R = 1 - \frac{6}{8(64-1)} = 1 - 0.0119$$

$$R = 0.988$$

Data Collection

Qualitative data collection through questionnaire to determine the risk associated with the human errors. Consent to undertake the study was obtained through a letter to the management and informed consent of the study participants who were assured of the skill-based errors of information collected. In addition, data were obtained from the central Bank of Nigeria (CBN) statistical bulletin, Nigerian Ports Authority website, Nigerian Maritime Administration and Safety (NIMASA) Websites, etc. Two basic instruments namely, questionnaire and document analysis have been used.

Method of Data Analysis

Hypotheses were then tested with the use of Pearson Product-Moment Correlation (PPMC) Coefficient. After making the necessary coding, to analyse the usable data collected from respondents Statistical Package for Social Sciences (SPSS) version 26 was used. Both descriptive and inferential are applied in order to come up with a better result. Descriptive statistics is used to describe a set of data in terms of its frequency of occurrence, its central tendency, and its dispersion. Correlation analysis and reliability test examined through employing inferential statistics.

RESULTS AND ANALYSIS

Correlation analysis was conducted for scale typed questionnaire. A total of 120 questionnaires were distributed to employees of shipping companies and 85 (70.8%) questionnaire were obtained valid and used for analysis. The collected data were presented and analysed using SPSS (version 17.0) statistical software. The study used correlation analysis, specifically Pearson correlation to measure the degree of association between different variables under consideration.

Table 1: Descriptive Analysis of Group Factors

Directional Statements Descriptive Statistics	N	Mean	Standard. Deviation
To what degree does incompetence contribute to work accident	85	3.2509	1.06722
To what degree does work stress contribute to work accident	85	3.3004	1.04418
To what degree does poor motivation contribute to work accident	85	3.3286	1.03217
To what degree does fatigue contribute to work accident	85	3.6325	0.84169
To what degree does emotional stress to contribute to work accident	85	3.7385	0.72604
Valid N (listwise)	85		

Source: Survey Data, 2025, and SPSS Window Output, Version 22.0

Table 1 shows the Individual Factors contribution to accident. The analysis indicates that the mean and standard deviation scores of 3.2509±1.06722, implies that the respondents collectively agreed that incompetence contribute to work accident. Also, with the mean and standard deviation scores of 3.3004±1.04418 the responses indicate that work stress contributes to work accident. The mean and standard deviation scores of 3.3286±1.03217 indicate that poor motivation contribute to work accident. The mean data and standard deviation scores of 3.6325±0.84169 suggest that fatigue contribute to work accident. Finally, the mean and standard deviation scores of 3.7385±0.72604 indicate that emotional stress contributes to work accident.

Table 2: Descriptive Analysis of Group Factors

Directional Statements Descriptive Statistics	N	Mean	Std. Deviation
To what extent does inadequate information from Management contribute to work accident	85	3.7739	0.69325
To what extent does inadequate Supervision contribute to work accident	85	3.6784	0.78492
To what extent does inadequate information from Crew contribute to work accident	85	3.7986	0.65644
To what degree does wrong command contributes to work accident	85	3.5018	0.87671
To what degree does inconsistent operational command to contribute to work accident	85	3.5265	0.88436
Valid N (listwise)	85		

Source: Survey Data, 2025, and SPSS Window Output, Version 26.0

Table 2 shows the responses on Group Factors contribution to accident. The analysis indicates that the mean and standard deviation scores of 3.7739±0.69325, implies that the respondents collectively agreed that inadequate information from Management contribute to work accident. Also, with the mean and standard deviation scores of 3.6784±0.78492 the responses indicate that inadequate Supervision contributes to work accident. The mean and standard deviation scores of 3.7986±0.65644 indicate that inadequate information from Crew contributes to work accident. The mean data and standard deviation scores of 3.5018±0.87671 suggest that fatigue contribute to work accident. Finally, the mean and standard deviation scores of 3.5265±0.88436 indicate that inconsistent operational command to contribute to work accident.

Table 3: Descriptive Analysis of Organizational Factors

Directional Statements Descriptive Statistics	N	Mean	Std. Deviation
To what extent does inadequate Company policies contribute to work accident	85	3.5048	1.60345
To what extent does Company Standards contribute to work accident	85	3.5264	0.52462
To what extent does inadequate information from Crew contribute to work accident	85	3.3524	0.24041
To what degree does Company Systems and Procedures contributes to work accident	85	3.1017	0.87351
To what degree does company work environment contribute to work accident	85	3.5145	0.89036
Valid N (listwise)	85		

Source: Survey Data, 2025, and SPSS Window Output, Version 26.0

Table 3 shows the responses on Organizational Factors contribution to accident. The analysis indicates that the mean and standard deviation scores of 3.5048±1.60345, implies that the respondents collectively agreed that inadequate Company policies contribute to work accident. Also, with the mean and standard deviation scores of 3.5264±0.52462 the responses indicate that Company Standards contribute to work accident. The mean and standard deviation scores of 3.3524±0.24041 indicate that inadequate information from Crew contributes to work accident. The mean data and standard deviation scores of 3.1017±0.87351 suggest that Company Systems and Procedures contribute to work accident. Finally, the mean and standard deviation scores of 3.5145±0.89036 indicate that company work environment contribute to work accident.

Table 4: Descriptive Analysis of Skill Based

Source: Survey Data, 2025, and SPSS Window Output, Version 26.0

Directional Statements Descriptive Statistics	N	Mean	Std. Deviation
To what degree does Action error a major accident caused by human factor	85	3.0573	0.75321
To what degree does checking error a major accident caused by human factor	85	3.4865	0.78492
To what degree does electronic command a major accident caused by human factor	85	3.7986	0.65644
To what degree does machine error a major accident caused by human factor	85	3.5238	0.79672
To what degree does system/process error a major accident caused by human factor	85	3.6065	0.58426
Valid N (listwise)	85		

Table 5 shows the responses on Skill Based Factors contribution to accident. The analysis indicates that the mean and standard deviation scores of 3.0573±0.75321, implies that the respondents collectively agreed that inadequate Action error a major accident caused by human factor. Also, with the mean and standard deviation scores of 3.4865±0.7892 the responses indicate that checking error a major accident caused by human factor. The mean and standard deviation scores of 3.7385±0.72604 indicate that electronic command a major accident caused by human factor. The mean data and standard deviation scores of 3.7986±0.65644 suggest that machine error a major accident caused by human factor. Finally, the mean and standard deviation scores of 3.6065±0.58426 indicate that system/process error a major accident caused by human factor.

Table 6: Descriptive Analysis of Rule Based

Directional Statements Descriptive Statistics	N	Mean	Std. Deviation
To what degree does Retrieval Error a major accident caused by human factor	85	3.0632	0.95073
To what degree does Transmission error a major accident caused by human factor	85	3.6754	0.76478
To what degree does ergonomics error a major accident caused by human factor	85	3.7880	0.83501
To what degree does job description a major accident caused by human factor	85	3.5018	0.87671
To what degree does system/process design a major accident caused by human factor	85	3.5265	0.88436
Valid N (listwise)	85		

Source: Survey Data, 2025, and SPSS Window Output, Version 26.0

Table 6 shows the responses on Rule Based Factors contribution to accident. The analysis indicates that the mean and standard deviation scores of 3.0632±0.95073, implies that the respondents collectively agreed that Retrieval Error a major accident caused by human factor. Also, with the mean and standard deviation scores of 3.6754±0.76478 the responses indicate that Transmission error a major accident caused by human factor. The mean and standard deviation scores of 3.7880±0.83501 indicate that ergonomics error a major accident caused by human factor. The mean data and standard deviation scores of 3.5018±0.87671 suggest that job description a major accident caused by human factor. Finally, the mean and standard deviation scores of 3.5265±0.88436 indicate that system/process design a major accident caused by human factor.

Table 7: Descriptive Analysis of Knowledge Based

Directional Statements Descriptive Statistics	N	Mean	Std. Deviation
To what extent does Diagnostic error a major accident caused by human factor	85	3.5327	0.78120
To what extent does Decision error a major accident caused by human factor	85	3.6706	0.60492
To what extent does ergonomics error a major accident caused by human factor	85	3.7986	0.65642
To what extent does job description error a major accident caused by human factor	85	3.6098	0.47621
To what extent does system/process design error a major accident caused by human factor	85	3.8260	0.28436
Valid N (listwise)	85		

Source: Survey Data, 2025, and SPSS Window Output, Version 26.0

Table 7 shows the responses on Knowledge Based Factors contribution to accident. The analysis indicates that the mean and standard deviation scores of 3.5327±0.78120, implies that the respondents collectively agreed that Diagnostic error a major accident caused by human factor. Also, with the mean and standard deviation scores of 3.6706±0.60492 the responses indicate that Decision error a major accident caused by human factor. The mean and standard deviation scores of 3.7986±0.65642 indicate that ergonomics error a major accident caused by human factor. The mean data and standard deviation scores of 3.6098±0.47621 suggest that job description a major accident caused by human factor. Finally, the mean and standard deviation scores of 3.8260±0.28436 indicate that system/process design a major accident caused by human factor.

Test of hypotheses

H_{o1}: there is no significant relationship between individual factors and skill-based error in maritime oil rigs in Nigeria.

The Table 8 shows the test result on relationship between individual factors and skill-based error in maritime oil rigs in Nigeria. The result shows that the rho outcome is 0.664** @ p 0.000 < 0.05, meaning that a strong positive relationship exists between the examined variables and it is also significant. This implies that the null hypothesis (H_{o1}) is rejected and the alternate hypothesis (H_{i1}) accepted, hence; "there is significant relationship between individual factors and skill-based error in maritime oil rigs in Nigeria.

Table 8: Results of Relationship between Individual Factors and Skill-based Error in Maritime Oil Rigs in Nigeria

Statistics	Individual Factors (IF)	Skill Based Error (SBE)
Pearson correlation individual factors (IF)		0.664**
Sig(2-tailed)		0.000
N		85
Pearson correlation- skill based error (SBE)	0.664**	
Sig(2-tailed)	0.000	
N	85	

**correlation is positive and significant at the 0.05 level (2-tailed)

Source: Survey Data, 2025, and SPSS Window Output, Version 26.0

H_{o2}: there is no significant relationship between individual factors and rule-based error in maritime oil rigs in Nigeria.

The Table 4.26 sows the test result on the relationship between individual factors and rule-based error in maritime oil rigs in Nigeria. It shows that the rho outcome is 0.594** @ p 0.000 < 0.05, meaning that there is a strong positive relationship existng between the examined variables and it is also significant. This implies that the null hypothesis (H_{o2}) is rejected and the alternate hypothesis (H_{i2}) accepted, hence; "there is significant relationship between individual factors and rule-based error in maritime oil rigs in Nigeria.

Table 9: Results of Relationship between Individual Factors and Rule-based Error in Maritime Oil Rigs in Nigeria

Statistics	Individual Factors (IF)	Rule Based Error (RBE)
Pearson correlation individual factors (IF)		0.594**
Sig(2-tailed)		0.000
N		85
Pearson correlation- rule based error (RBE)	0.594**	
Sig(2-tailed)		
N	0.000	
	85	

**correlation is positive and significant at the 0.05 level (2-tailed)

Source: Survey Data, 2025, and SPSS Window Output, Version 26.0

H_{o3}: there is no significant relationship between individual factors and knowledge-based error in maritime oil rigs in Nigeria.

The Table is the test result of the relationship between individual factors and knowledge-based error in maritime oil rigs in Nigeria which shows that the rho outcome is 0.436** @ p 0.024 < 0.05, meaning that a strong positive relationship exists between the examined variables and it is also significant. This implies that the null hypothesis (H_{o3}) is rejected and the alternate hypothesis (H_{i3}) accepted, hence; "there is significant relationship between individual factors and knowledge-based error in maritime oil rigs in Nigeria.

Table 10: Results of Relationship between Individual Factors and Knowledge-Based Error in Maritime Oil Rigs in Nigeria

Statistics	Individual Factors (IF)	Knowledge Based Error (KBE)
Pearson correlation individual factors (IF)		0.436**
Sig(2-tailed)		0.024
N		85
Pearson correlation- knowledge based error (KBE)	0.436**	
Sig(2-tailed)		
N	0.024	
	85	

**correlation is positive and significant at the 0.05 level (2-tailed)

Source: Survey Data, 2025, and SPSS Window Output, Version 26.0

H_{o4}: there is no significant relationship between group factors and skill-based error in maritime oil rigs in Nigeria.

The Table 10 is the relationship between group factors and skill-based error in maritime oil rigs in Nigeria which shows that the rho outcome is 0.786** @ p 0.004 < 0.05, meaning that a strong positive relationship exists between the examined variables and it is also significant. This implies that the null hypothesis (H_{o4}) is rejected and the alternate hypothesis (H_{i4}) accepted, hence; "there is significant relationship between relationship between group factors and skill-based error in maritime oil rigs in Nigeria.

Table 11: Results of Relationship between Group Factors and Skill-Based Error in Maritime Oil Rigs in Nigeria

Statistics	Group Factors (GF)	Skill Based Error (SBE)
Pearson correlation Group factors (GF) Sig(2-tailed) N		0.786** 0.004 85
Pearson correlation- skill based error (SBE) Sig(2-tailed) N	0.786** 0.004 85	

**correlation is positive and significant at the 0.05 level (2-tailed)
Source: Survey Data, 2025, and SPSS Window Output, Version 26.0

H_{o5}: there is no significant relationship between group factors and rule-based error in maritime oil rigs in Nigeria
The Table 4.29 is the relationship between group factors and rule-based error in maritime oil rigs in Nigeria which shows that the rho outcome is 0.587**@ p 0.016 < 0.05, meaning that a strong positive relationship exists between the examined variables and it is also significant. This implies that the null hypothesis (H_{o5}) is rejected and the alternate hypothesis (H_{i5}) accepted, hence; "there is significant relationship between relationship between group factors and rule-based error in maritime oil rigs in Nigeria.

Table 12: Results of Relationship between Group Factors and Rule-Based Error in Maritime Oil Rigs in Nigeria

Statistics	Group Factors (GF)	Rule Based Error (RBE)
Pearson correlation Group factors (GF) Sig(2-tailed) N		0.587** 0.016 85
Pearson correlation- rule based error (RBE) Sig(2-tailed) N	0.587** 0.016 85	

**correlation is positive and significant at the 0.05 level (2-tailed)
Source: Survey Data, 2025, and SPSS Window Output, Version 26.0

H_{o6}: There is no significant relationship between group factors and knowledge-based error in maritime oil rigs in Nigeria
The Table 12 is the relationship between group factors and knowledge-based error in maritime oil rigs in Nigeria shows that the rho outcome is 0.887** @ p 0.000 < 0.05, meaning that a strong positive relationship exists between the examined variables and it is also significant. This implies that the null hypothesis (H_{o6}) is rejected and the alternate hypothesis (H_{i6}) accepted, hence; "there is significant relationship between relationship between group factors and knowledge-based error in maritime oil rigs in Nigeria.

Table 13: Results of Relationship between Group Factors and Rule-Based Error in Maritime Oil Rigs in Nigeria

Statistics	Group Factors (GF)	Knowledge Based Error (KBE)
Pearson correlation Group factors (GF) Sig(2-tailed) N		0.887** 0.000 85
Pearson correlation- rule based error (SBE) Sig(2-tailed) N	0.887** 0.000 85	

**correlation is positive and significant at the 0.05 level (2-tailed)
Source: Survey Data, 2025, and SPSS Window Output, Version 26.0

H_{o7}: there is no significant relationship between organizational factors and skill-based error in maritime oil rigs in Nigeria.
The Table 4.31 is the relationship between organizational factors and skill-based error in maritime oil rigs in Nigeria shows that the rho outcome is 0.805** @ p 0.000 < 0.05, meaning that a strong positive relationship exists between the examined variables and it is also significant. This implies that

the null hypothesis (H_{o7}) is rejected and the alternate hypothesis (H_{i7}) accepted, hence; "there is significant relationship between organizational factors and skill-based error in maritime oil rigs in Nigeria.

Table 14: Results of Relationship between Organizational Factors and Skill-Based Error in Maritime Oil Rigs in Nigeria

Statistics	Organizational Factors (OF)	Skill Based Error (SBE)
Pearson correlation Organizational factors (OF)		0.805**
Sig(2-tailed)		0.000
N		85
Pearson correlation- rule based error (SBE)	0.805**	
Sig(2-tailed)	0.000	
N	85	

**correlation is positive and significant at the 0.05 level (2-tailed)

Source: Survey Data, 2025, and SPSS Window Output, Version 26.0

H_{o8}: there is no significant relationship between organizational factors and rule-based error in maritime oil rigs in Nigeria.

The Table 14 is the test result of the relationship between organizational factors and rule-based error in maritime oil rigs in Nigeria. It shows the rho as 0.485^{**} @ p 0.034 < 0.05, meaning that a positive relationship between the examined variables which is significant. This implies that the null hypothesis (H_{o8}) is rejected and the alternate hypothesis (H_{i8}) accepted, hence; "there is significant relationship between organizational factors and rule-based error in maritime oil rigs in Nigeria.

Table 15: Results of Relationship between Organizational Factors and Rule-Based Error in Maritime Oil Rigs in Nigeria

Statistics	Organizational Factors (OF)	Rule Based Error (RBE)
Pearson correlation Organizational factors (OF)		0.485**
Sig(2-tailed)		0.034
N		85
Pearson correlation- rule based error (RBE)	0.485**	
Sig(2-tailed)	0.034	
N	85	

**correlation is positive and significant at the 0.05 level (2-tailed)

Source: Survey Data, 2025, and SPSS Window Output, Version 26.0

H_{o9}: there is no significant relationship between organizational factors and knowledge-based error in maritime oil rigs in Nigeria.

The Table 15 is the relationship between organizational factors and knowledge-based error in maritime oil rigs in Nigeria. It shows that the rho outcome is 0.732 @ p 0.017< 0.05, meaning that a strong positive relationship exists between the examined variables and it is also significant. This implies that the null hypothesis (H_{o9}) is rejected and the alternate hypothesis (H_{i9}) accepted, hence; "there is significant relationship between organizational factors and knowledge-based error in maritime oil rigs in Nigeria.

Table 16: Results of Relationship between Organizational Factors and Knowledge-Based error in Maritime Oil Rigs in Nigeria

Statistics	Organizational Factors (OF)	Knowledge Based Error (KBE)
Pearson correlation Organizational factors (OF)		0.732**
Sig(2-tailed)		0.017
N		85
Pearson correlation- rule knowledge error (KBE)	0. 732**	
Sig(2-tailed)	0.017	
N	85	

**correlation is positive and significant at the 0.05 level (2-tailed)

Sources: Survey Data, 2025, and SPSS Window Output, Version 26.0

Table 17: Summary of the Results on Test of the Research Hypotheses

Research Hypotheses	r – value	Result	Decision
Ho_1: There is no significant relationship between individual factors and skill-based errors	0.664	Positive and Significant	Reject

Ho_2: There is no significant relationship between individual factors and rule-based errors	0.594	Positive and Significant	Reject
Ho_3: There is no significant relationship between individual factors and knowledge-based errors	0.436	Positive and Significant	Reject
Ho_4: There is no significant relationship between group factors and skill-based errors	0.786	Positive and Significant	Reject
Ho_5: There is no significant relationship between group factors and rule-based errors.	0.587	Positive and Significant	Reject
Ho_6: There is no significant relationship between group factors and knowledge-based errors.	0.887	Positive and Significant	Reject
Ho_7: There is no significant relationship between organisational factors and skill-based errors	0.805	Positive and Significant	Reject
Ho_8: There is no significant relationship between organisational factors and rule-based errors.	0.485	Positive and Significant	Reject
Ho_9: There is no significant relationship between organisational factors and knowledge-based errors.	0.732	Positive and Significant	Reject

Source: Survey Data, 2025, and SPSS Window Output, Version 25.0

Hi_1: There is significant relationship between individual factors and skill based errors; Hi_2: There is significant relationship between individual factors and rule-based errors; Hi_3: There is significant relationship between individual factors and knowledge-based errors; Hi_4:There is significant relationship between group factors and skill based errors; Hi_5:There is significant relationship between group factors and rule-based errors.; Hi_6:There is significant relationship between group factors and knowledge-based errors; Hi_7:There is significant relationship between organisational factors and skill based errors; Hi_8:There is significant relationship between organisational factors and rule-based errors; Hi_9:There is significant relationship between organisational factors and knowledge-based errors;

DISCUSSION

The findings of this study were drawn from the results of the study analyses. In this section, the study discussed the findings and drew conclusions. The first section deals with the relationship between individual factors and human error contributing to accident, the second section centres on relationship between group factors and human error contributing to accident**,** the third section focuses on the relationship between organisational factors and human error contributing to accident.

Relationship between individual factors and Human Error Contributing to Accident

The findings related to individual factors and human error contributing to accident revealed that individual factors relate with human error contributing to accident. A critical appraisal of the finding reveals that a strong, positive, and significant relationship exist between individual factors and skill-based errors as the measure of human error contributing to accident with r -value of 0.664. This finding agrees with ILO (2014) who reportedly found that organisations that harness individual factors manage risks super normally as they sustain skill-based errors. Boughaba *et al*. (2014) found that attitude to teamwork and leadership are predominant causal factors among drilling teams in the upstream oil and gas sector. Further evidence from results shows that failure to correct problems, planned inappropriate operations and supervisory violations led to physical and mental limitations in workers.. Also, Christ (2015) found that individual factors are characterized by stress that the complex nature of oil and gas operations affects the ability of workers to effectively conduct safe operations. There were also issues with the physical and technological environments, which were both caused by failure to correct problems and supervisory violations. Also, Matooq and Suliman (2013) are in agreement that individual factors improve the quality of organizational human error contributing to accident and the nature of the oil and gas work environment has an extremely high-risk profile, thus increasing the likelihood and severity of accidents. Det Norske and Germanischer (2016) found that individual factors in addition to other causal factors that triggered flaws in the process safety culture, organizational climate and resource management. Turtiainen & Väänänen (2012) revealed that the poor process safety culture and organizational climate in turn led to inadequate supervision and failing to correct known problems due to a lack of management commitment.

Mason *et al*. (2015) study align with the finding of this study as they maintain that weaknesses in the technological environment also increased alongside acts of sabotage. Routine violation of procedures was usually caused by a fair number of underlying factors such as lack of personal readiness, poor crew resource management, physical/mental limitations of workers, adverse mental state of employees and unsafe physical environment. In support of this Mattia (2013) observed that individual factors provide evidence that decision errors were triggered by poor crew resource management while skill-based errors were caused by personal readiness, crew resource management, physical/mental limitations and adverse mental state of workers. Routine drills, exercises and refresher trainings are pivotal in ensuring that workers make the right decisions when confronted with emergency situations.

Further critical analysis of the finding reveals that a positive and significant relationship exists between individual factors and rule-based errors as a measure of human error contributing to accident in rig platforms with r -value of 0.594. In this respect the study found that ensuring rule-based errors, it is important to take a holistic approach to accident prevention and consider all of the potential factors when developing safety plans and protocols. Skill-based errors usually consist of attention, memory, and technical errors. Memory failures frequently appear as omitted items in a checklist or forgotten goals, and attention failures link to many factors such as the breakdown in visual scan patterns, task fixation, the accidental activation of controls, the mis-ordering of steps in a procedure, and technical failures that develop depending on an employee’s training experience, educational background, perspective, and approach to events. The study revealed that skill-based errors mainly cause maintenance repair and loading unloading accidents. It has been determined that technical errors in maintenance repair and attention errors in loading unloading (Nordlöf *et al*., 2015). There were no constituent elements of human error contributing to accident at the individual level, which is surprising since it is generally agreed that overall protection is dependent on the weakest link, which is usually the individual (Unnikrishnan *et al*., 2015).

The finding also, reveals that a positive, and significant relationship exists between individual factors and knowledge-based errors as a measure of human error contributing to accident in rig platforms with r -value of 0.436. The study found that procedural errors refer to a lack of procedures, unclear procedures, or an insufficiency of procedures. In such operational accidents, procedural manifestations such as “emergency operating procedures”, “operational procedures”, “maintenance procedures”, “training procedures”, “safety procedures”, and “work permit system procedures” are frequently encountered. A lack of or inadequate safety operation procedures are the important causes of casualty accidents. The findings are consistent with numerous prior types of research that indicate a statistically significant correlation between individual factors and human error contributing to accident (Salminen, 2011). The results, however, contradict works of (Payne, 2011; Walters *et al*., 2013).

Relationship between Group factors and Human Error Contributing to Accident

The findings associated with the relationship between group factors and human error contributing to accident, point to the fact that, group factors engender human error contributing to accident. A critical analysis of finding reveals that a strong, positive, and significant relationship exists between group factors and skill-based errors as a measure of human error contributing to accident in rig platforms. In with r -value of 0.786. This study has identified possible human errors that can result in fires/explosions during oil mining operations at a petroleum terminal. Risk control solutions are developed to minimize the human errors. Data collected indicates that majority of operators recognized the requirement for having fire extinguishers around tankers’ manifold areas during terminal operations. However, they partially know the required conditions to carry out hot work. Results from open ended questions asked showed that around half of operators would use gas detectors to keep monitoring atmosphere quality at the work area. Nevertheless, none one mentioned the importance of having good housekeeping to free work areas from combustible materials before performing any hot work. In addition, operators expressed that the company provides enough information such as standards and rules, to prevent fires/explosions during operations at the terminal; however, 10% said that existing abundance of information limit the adequate problem-solving process. This finding aligns with the study of Manchi *et al*. (2013) that showed that different group factors provide different values for companies and these values can complement each other which improves companies’ human errors contributing to accident. However, Marcella *et al*. (2011) found that handling of heavy machinery, uncomfortable ergonomic postures and probably working long hours makes the workers vulnerable to human driven errors, health diseases and illness. Also, the organizational and robustness of the trainings required to keep them informed about the hazards and accidents they may encounter has also been identified as an important factor to consider.

Zakaria *et al*. (2012) group factors, skilled-based error and personal readiness played a role in 53% of the accidents, while routine violation caused 50%. Therefore, the evidence suggests that the working conditions of contractors put them at risk of exposure to accidents as they are the main operating staff in the oil and gas industry.

A critical examination of the finding discloses that a strong, positive, and significant relationship exists between group factors and rule-based errors as a measure of human error contributing to accident in rig platforms with r -value of 0.587. The finding is supported by Freije (2015) posits that group factors is characterized by its mixed poor safety culture and climate as key drivers of accident causation in the oil and gas industry.

Besnard and Hollnagel (2012) submit that crew resource management flaws were significantly influenced by inadequate supervision, failure to correct problems and supervisory violations. Abbe *et al*. (2011) argue that lack of operational discipline could lead to routine violations, especially when there is poor safety climate throughout the organization. Perceptual errors were also jointly caused by an adverse physiological state, an adverse mental state and physical/mental limitations. For Paraventi (2014) found that the risk perception of workers is suggested to be improved by ensuring that competent workers with adequate knowledge, ability, training and experience are selected for specialized tasks. In this regard Economic (2016) found that poor safety culture and climate as key drivers of accident causation in the oil and gas industry.

A vivid examination of the finding discloses that a strong, positive, and significant relationship exists between group factors and knowledge-based errors as a measure of human error contributing to accident in rig platforms with r -value of 0.887. The study also found that the organizational process is the main reason for process, storage, and shutdown startup accidents with the highest weight values. Procedural errors are the most widespread in all three operations. Naser (2011) found that the procedures in the oil rig platforms should be fit for purpose, written, and up to date to prevent errors and that resource management causes, such as lack of machinery spare parts, alarm systems, or safety equipment, and defective design of plants are frequently involved in operation accidents.

Díaz-de-Mera-Sanchez *et al*. (2015) found that resource management impacts operation violations in hazardous chemical accidents and that resource management was one of the most influential factors contributing to process accidents. Hassanzadeh (2013) found that in the shipping industry, the

International Safety Management (ISM) Code mandates that shipping companies establish procedures that allow seafarers to take part in risk identification, assessment, and mitigation, and report safety lapses and issues. The Code, in principle, encourages a safe place strategy.

The finding of this study agrees with Achaw and Boateng (2012) study that established a positive relationship between group factors and knowledge-based errors. The study revealed that by forecited procedural errors, and those exceedingly foreseen in the organizational process, are more significant in operations. This is in line with the findings of Johnson *et al*. (2013), they submitted that adequate resources were one of the primary safety motivators for employees. The organizational process describes how oil rig platforms are standardized and managed using various procedures and frameworks. Therefore, vulnerabilities in operational management are likely caused by poor organizational processes.

Relationship between organisational factors and Human Error Contributing to Accident

The result associated with the relationship between organisational factors and human error contributing to accident, points to the fact of close relationship. A closer examination of the finding reveals that a strong, positive, and significant relationship exists between organisational factors and knowledge-based errors as a measure of human error contributing to accident with r -value of 0.805. This finding agrees with the works of Edwards *et al*., (2013) that organisational factors and human error contributing to accident have significant relationship. The point is that organisational factors allow or permits the organisations to match security matters with component information essentials (Det Norske Veritas & Germanischer Lloyds (DNVGL), 2016). According to Pitblado and Nelson (2013) organisational factors also have similar impact on human error contributing to accident. This view is supported by Bhavsar *et al*., (2015) as they found that contractors are usually unfamiliar with the work environment and often have disparities in safety standards and processes from their contracting organizations.

Achaw and Boateng (2012) maintain that there are huge flaws in the organizational process and technology used in carrying out these operations. Ideally, human factor analysis examines the relationship between man (contractor), machine (technology) and procedure (process). Besides, these three main facets of human factors were identified as the main causes of accidents (Turtiainen & Väänänen 2012). The efficiency of accident learning depends on in-depth cause analysis and a combination of many different causes lead to significant chemical accidents as shown in Awodele *et al*. (2014). To map a collection of tasks to aset of resources, there are two approaches: static scheduling and dynamic scheduling.

Matooq and Suliman (2013) observed that the organisational level is where the most internal control can be exercised to promote an externally focused strategic implementation of human error contributing to accident and it deserves particular consideration in the review of literature. Walters *et al*. (2013) found that the knowledge of the causes of accidents is the most significant material when drawing lessons from them. For example, in this study, 251 accidents were investigated, and a total of 996 reasons were obtained, showing an average of 3.96 causes for each accident. For this reason, it is seen that more than one human factor affects the accidents that occur in the oil rig platforms.

Zakaria *et al*. (2012) revealed that it is essential to prioritize resource management issues and organizational processes in every operation. Poor technological environments include things such as defective equipment and facilities, a lack of safety precautions, a lack of electronic monitoring tools, irrational control layouts, etc.

De Mora *et al*. (2010) found that if issues are not identified or resolved quickly, or risks are not sufficiently addressed, a poor technological environment can easily increase the risks of accidents. Besnard and Hollnagel (2012) found that Supervisory violation is frequently defined as the manager or supervisor disregarding the established operating procedures. An insufficient safety culture can be regarded as one of the contributing factors to supervisory violations. It has been observed that non-compliance with actions of permit-to-work, allowing not using personal protective equipment (PPE), violated procedures, and willful disregard for authority by supervisors would be classified as supervisory violations in operations. Therefore, it would be beneficial to focus on management violations in operations to minimize the accidents resulting from management violations. Unsafe acts are wrong judgment and wrong response to an emergency, decisions due to poor practice, and decisions on using incorrect tools. (Pitblado & Nelson, 2013). Although strongly effective for knowledge-based errors purposes, data replication techniques are always an important issue in individual factors, given the framework levels (resource management, organizational process, supervisory violations, personal readiness, technological environment, and decision errors) involved.

A critical analysis of the finding reveals that a strong, positive, and significant relationship exists between organisational factors and rule-based errors as a measure of human error contributing to accident in rig platforms with r -value of 0.485. In the maritime industry [63], safety training was the second most significant predictor of safety supervision. The same study's results indicated that the quality of the safety inspection would be high if crew members were well-trained in following safety rules and procedures (Boughaba *et al*., 2014).

A critical analysis of the finding reveals that a moderate, positive, and significant relationship exists between organisational factors and knowledge-based errors as the measure of human error contributing to accident in rig platforms with r -value of 0.732. The results agreed with Economic (2013) who found that organisational factors cause the knowledge-based errors in rig platforms. Matooq and Suliman (2013) found that regardless of these factors' effect, efficient control can reduce the frequency and severity of accidents in the identified operations. For example, effective resource management can ensure that the equipment, materials, and personnel are available to carry out the operations safely and efficiently. In addition, a favorable technological environment can reduce the likelihood of equipment failures and malfunctions, leading to accidents. Finally, personal readiness can ensure that the personnel involved in the operations are adequately trained, experienced, and prepared to handle any unexpected situations.

Conclusion

The purpose of the study was to identify possible human errors that results to accidents in an oil rig platforms and terminals in Nigeria. The objectives of this study were to determine the relationship between individual factors and accidents occurrence on maritime oil rig platforms in Nigeria; to determine the relationship between group factors and accidents occurrence on maritime oil rig platforms in Nigeria; and to determine the organisational factors and accidents on maritime oil rig platforms in Nigeria.

From the study, it was discovered that terminal operators defined their job as a highly routinised condition. This situation could be cause for root errors since human recognition schema can accept as a match for the proper object something that looks like it. Operators didn't completely know the rule's requirements to carry out hot-work and to compliance with the permit. This situation could cause root errors since matching conditions of a particular situation are misrepresented. Then an inappropriate rule is applied. 100% of operators limited their inspections just to items on the check-list, although 30% said that these lists don't cover all the safety aspects involved in the operation. This situation could cause root errors since the operator is likely to assume that all possible factors have been considered. In terms of a knowledge-based assessment, the operators admitted that mistakes will occur if attention is given to a wrong feature condition. Concerning "Out of sight/out of mind" situations, ignoring what is not present. 60% - 70% of operators incompletely answered group of situations that require maintenance of cargo tanks in non-flammable conditions. This could cause root errors since operators ignore part of the group of situations required.

Recommendations

From findings of the study, the following recommendations were proffered:

1) Oil terminal operators and the maritime industry at large should engage employees on regular training to be abreast with every necessary measure to risk control and well as getting in-depth knowledge of the job.
2) Oil terminal companies and the maritime industry must focus training on specific issues which may include group performance duties and responses.
3) In order to be more guided and appropriate, organization should well define operations and avoid cumbersome and vague description of work routines to groups and individuals.

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