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Human Factors as Determinants of Marine Accidents in Maritime Companies in Nigeria

O.O. Oluseye [1,*], O.O. Ogunseye[2]

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ABSTRACT

The capacity to address marine accidents could be enhanced through a thorough knowledge of what constitutes human factors and how they affect marine safety performance. This study investigated human factor issues that are responsible for maritime accidents in Nigeria and therefore gives maritime practitioners strategies for policy interventions. The study adopted a descriptive methodology, making use of survey design to collect data from 284 marine service operators in Nigeria. Data for the study was collected through semi-structured questionnaires, same were analysed through descriptive and inferential statistical tools such as mean, standard deviation, correlation and regression analysis at p¡0.05. Results showed that nine human related factors are major causes of marine accidents; namely: poor crew interaction, crew fatigue, drugs and alcoholism, unsafe vessel speed, commercial pressure from management, complicated work processes, gap in working knowledge, faulty crew judgment and deliberate unruly behaviour; while five of them: crew fatigue, drugs and alcohol, unsafe vessel speed, faulty crew judgment and wilful behaviour of crewmembers, were significantly related to safety performance. The study established that human errors are contributory factors to marine accidents and relationships exist between them and safety culture, hence, human factors can predict safety performance in maritime organizations in Nigeria. It is therefore recommended that Marine Safety Performance Plan, which is part of the International Safety Management (ISM) Code, be implemented in all maritime companies in Nigeria. Alcoholism, indiscriminate drug and substance use should be discouraged onboard while a stress management policy should be designed to handle work-related fatigue.

1. Introduction

Accidents are undesired events resulting from unexpected combination of conditions that lead to adverse consequences such as injury, loss of life, economic loss, environmental damage and damage to or loss of property (Ceyhun, 2014). Accident also refers to anything that happens without foresight and expectation; an unusual event, which proceeds from unknown cause or is an unusual effect of a known cause (Akten, 2006). The terms 'marine accident and incident' and 'marine casualty' denote undesirable events arising from shipping operations (International Maritime Organisation (IMO), 1996). Accidents occur in almost all spheres of human existence and in most industrial occupations - manufacturing, construction, marine and air transportation, atomic energy etc. Accidents are not only injurious to lives and properties, but also hinder corporate business success. Consequently, a high level of safety performance is essential in hazardous work environments. As an unintentional event, accident involving marine vessel is common in inland and coastal navigation where requisite safety regulation may not be strictly observed. For marine organizations, an important concern is how to prevent vessel casualties involving personal injury, deaths, property and environmental damage by establishing and maintaining a culture of strict adherence to safety practices.

In Nigeria, the number of marine accidents increases with

[1]Southampton Solent University, Southampton, United Kingdom. Nigeria. E-mail address: captopy@yahoo.com.

[2]Department of Environmental Health Sciences, Faculty of Public Health, College of Medicine, University of Ibadan, Ibadan, Nigeria. E-mail address: sholybliss4eva@gmail.com

[*]O.O. Oluseye. E-mail address: captopy@yahoo.com.

increase in the level of oil prospecting and other maritime transport activities along the Niger-Delta and coastal regions (Onwuegbuchunam, 2013). For example, it has been documented that between year 2000 and 2009, a total number of 552 persons died either as a result of marine vessel and boat capsizing or collision in inland waters of Nigeria (Dogarawa, 2012). Thus, an average fatality rate of about 55 deaths per year excluding vessel and cargo losses which have been recorded in Nigeria's coastal and inland waterways in the last ten years (Ekpo, 2012). When accidents such as described above occur at sea, it is the norm within the industry to investigate, with the view of identifying the cause(s), evaluate its effects on lives and property, proffer remedial solutions and establish a system to prevent reoccurrence in future. In the past, the causes of marine accidents were mostly attributed to technological breakdown while the human element was neglected (Wayne et al., 2005). However, with continuous improvement in vessel design, technical infrastructure and global regulatory supervision, the frequency of technological failures has diminished and human factors have become more apparent determinant of marine accidents (Dogarawa, 2012; Cormier, 1994). The understanding is that performance of a highly complex socio-technical system such as marine vessel is dependent upon the interaction between technical, social, environmental and human elements; factors that can be important contributors to incidents which could potentially lead to catastrophe at sea (Wayne et al., 2005). (Rothblum, 2000) defined human factor as one of the following: incorrect decision, an improperly performed action or a lack of action (inaction). For the purpose of this study, human factor is described as behaviorally-related acts of omission or commission arising from people, structure and processes that may lead to injury, deaths or damage to either vessel, cargoes or the marine environment. An array of examples are documented in global maritime literature indicating the significance of human factor in relation to maritime safety management.

For instance,(Darbra and Casal, 2004) in their study on 471 cases of marine accidents that occurred from 1941 - 2002 in Hong Kong observed that human factors accounted for about 57% of accidents which occurred while vessel was underway at sea and 43% of accidents occurred while berthing at ports. In like manner, the Canadian Transportation and Safety Board in 1994 reported that between the periods of 1995 - 1996; 49% of marine vessel incidents were attributed to human factors, 35% due to technical factors while 16% were caused by environmental factors. Similarly, (Rothblum et al., 2002) reported that between 75 and 96% of marine vessel casualties are caused at least in part by some form of human error. Further empirical evidence also indicates that human error accounts for 84 - 88% of tanker accidents, 79% of towing vessel groundings, 89 - 96% of collisions, 75% of all collisions, 75% of fires and explosions (Bryant, 1991). These are gruesome statistics given the level of measures so far adopted by local and international organizations to improve the standard of shipping and navigation. Based on the above statistics, it would not be out of place to assert that two-third of marine accidents were due to human error, which according to (O'Neil, 2000), may include: carelessness or recklessness under commercial pressures, a misplaced sense of overconfidence or lack of either knowledge or experience.

(Rothblum et al., 2002) also identified some other human factors such as over-loading, excessive speeding, poor attention to weather conditions, fatigue, carelessness, calculated risk, improper loading, lack of training, cultural differences, incompetence and inadequate navigational aids. The shipping industry cannot go on this way, with several deaths from accidents among seafarers every year. Thus, it may be argued that perhaps the cause of most marine accidents is related to human influence. The human factor plays a very vital role in the shipping industry. Ships require well trained and highly motivated crew in order to operate safely and efficiently. Nevertheless, when considering maritime safety, it is necessary to address both the human element and the cultural dimensions in which human behavior occurs. Behavior can be acquired through learning, and when practiced consistently, it becomes an acceptable social norm transferred from one generation to another in form of culture. Culture is a way of life; the customs, beliefs and attitudes that people in a particular group or organization share. The manner in which an organization continuously executes work roles and tasks explains the particular culture holding sway in the organization. Thus, it appears that attitude and behavior towards maritime safety is perhaps shaped by prevailing organizational culture. (Frank, 2005) defined safety culture as a subset of the organizational culture while organizational culture is the product of multiple interactions between people, jobs and the organization. It can also be conceived as the set of values, beliefs and norms about what is important, how to behave and what attitudes are appropriate when it comes to crew safety in a work group. Workers perception of safety in the workplace can be positive, negative or neutral, and when learned and appropriately internalized, safety culture creates an environment that influences how well people communicate, plan and make decisions concerning their health and safety onboard (Lu and Tsai, 2007). Hence, an effective safety culture requires the active collaboration between management and the workforce. Since effective safety performance thrives on the basis of the prevailing safety culture in the organization, issues of safety culture appears to be associated with human causes of vessel accidents.

The statistical evidence is no doubt overwhelming but one wonders whether these findings would still hold in a developing nation like Nigeria, considering the socio-cultural context and geographical differences with which maritime business is transacted. It is yet to be empirically determined and documented whether the human causes of accidents are the same in Nigeria as reported elsewhere in global maritime literature. In situations where these factors are probably similar, maritime literatures have not been explicit on the individual or combined effects of the human factors that could accurately predict the rate of accident and safety performance in Nigeria. Despite the alignment of safety regulations with organizational culture and behavior by maritime policy makers, vessel accidents are still on the increase thereby casting doubts on the efficacy of relationship between safety culture and safety performance. Accordingly, in the context of Nigeria maritime environment, we attempt in this study to ascertain whether there is an association between safety culture practices and safety performance in

terms of minimizing marine accidents.

In Nigeria context, there is paucity of data on the relationship between safety culture, human behavior and safety performance, consequently, there exists a possibility for policy makers in this all-important industry to make sub-optimal decisions where sufficient empirical conclusions and conceptual models are unavailable to guide proper decision making. Hence, this study examines the behavioral components of maritime safety with the view to determining the human factors responsible for marine accidents in Nigeria.

2. Methology

2.1. Study design

This study was descriptive and quantitative in approach. It adopts survey and data was collected from seafaring respondents (shipping crew members, master mariners, marine engineers, sailors, deck crew, cargo surveyors, safety coordinators and other onboard technicians) through semi- structured questionnaires.

2.2. Study area

The study was carried out in Nigeria maritime industry, comprising offshore oil exploration and prospecting firms, Floating Production Storage and Offloading (FPSO) vessels, merchant shipping companies, maritime services companies and Nigerian Port Authority in Nigeria. The Nigeria maritime sector is an embodiment of economic activities such as exploration, water transportation, deep and shallow water port operation, cargo and freight business etc.

2.3. Study population

The study targeted maritime sector employees whose firms are currently operating in the coastal areas of Nigeria. There are over forty-six (46) of such licensed maritime firms with current operating activities in Lagos State and other locations like Warri, Delta State and Port Harcourt, Rivers State. A list from the Nigerian Maritime Administration and Safety Agency (NIMASA), the umbrella regulatory agency for the industry showed that an aggregate of 4,041 marine operators are currently employed with the listed firms. The population size was also authenticated by a list of registered members sighted at the secretariat of the National Association of Maritime and Dock Workers' Union.

2.4. Sampling procedure

The Nigeria maritime industry was stratified into three clusters of maritime operators: A, B and C. Cluster A are firms operating within Lagos State (commercial capital and hub of maritime activities in Nigeria), Cluster B constituted maritime companies in Port Harcourt, Rivers State while Cluster C comprised of multinational oil firms and maritime organizations in Warri, Delta State. Estimate of sample size from the study population was calculated using Taro Yamane's sample size calculator using 95% level of confidence and 0.05 margin of error (Matthews and Ross, 2010). This yielded a value of approximately 400 respondents. The calculated sample size was proportionally allocated to the three stratified clusters and questionnaires were administered accordingly.

2.5. Data collection

Data for this study was collected from primary and secondary sources to enable extensive coverage and reliable conclusions. The primary source was from semi-structured questionnaires while the secondary component comprised peer reviewed journal articles and relevant internet materials. The questionnaire comprised of two parts. The first part collected socio-demographic data such as age, educational background, years of marine experience, position in the organization etc., while the second part of the questionnaire collected data on: human factors associated with marine accidents, safety culture practices, behavioral factors and safety intervention programmers/accident prevention strategy.

2.6. Data management and statistical analysis

Data was entered and analyzed using statistical package for the social sciences (SPSS) version 20. Descriptive and inferential statistics were used in this study. Percentages, mean scores and standard deviation were used for descriptive analysis. The mean score was derived by dividing the sum of the scale by 5 to get a mean score of 3.00. Mean scores $\geq$ 3.00 was taken as positive strategy in responding to the factors affecting marine accident. Thus, a mean score less than 3.00 was considered an index of non-agreement, such factor was not considered very important in causing marine accident. Pearson correlation and multiple regression analysis were used to make statistical inferences.

3. Results

3.1. Respondents' socio-demographic characteristics

Table 1 shows the socio-demographic distribution of respondents. The table reveals that the majority of respondents (38.0%) were between ages 31-40 years. Similarly, 26.8% of respondents were aged 20-30 years while 16.5% and 18.7% were aged 41-50 years and 51-60 years respectively. This implies that majority of participants in this study were considered young, energetic and still in their productive working age. Majority of the respondents were onboard officers (43.1%) holding HND/BSc degree (43.7%) with maritime experience of 16 years and above (38.4%). Given these characteristics, they were expected to be of sound mind and body to understand the central theme of this investigation and to make meaningful contributions.

3.2. Human factors associated with marine accidents in Nigeria

Several factors are related to marine accidents in Nigeria. Result of data analysis revealed various human behavioral factors perceived by respondents as causing marine accidents in the study area. Table 2 presents crucial human factors that cause marine accidents on Nigeria waters. The result showed

Table 1: Distribution of respondents by socio-demographic characteristics

Demographic characteristics	Variable	Frequency (%)
Age	20-30 years	76(26.8)
	31-40 years	108 (38.0)
	41-50 years	47 (16.5)
	51-60 years	53 (18.7)
Educational status	FSLC	3 (1.1)
	SSC	37 (13.0)
	NCE/ND	85 (29.9)
	HND/B.Sc.	124 (43.7)
	Certificate of Competency	25 (8.8)
	Master degree	10 (3.5)
Position at work	Specialist/Advisor	18 (25.0)
	On board officer	31 (43.1)
	Operator/Technician	12 (16.7)
	Cadet	8 (11.1)
Years of marine experience	Below 5 years	39 (13.7)
	5-10 years	56 (19.7)
	11-15 years	80 (28.2)
	16 years and above	109 (38.4)

FSLC: First School Leaving Certificate; SSC: Senior Secondary Certificate; NCE/ND: National Certificate/ National Diploma; HND/BSc: Higher National Diploma/Bachelor's degree

Source: Field Survey, 2015

that out of the thirteen (13) factors suggested, respondents perceived nine (9) as frequent human causes of accidents, while four (4) were not regarded as serious human factors that result in accidents. They were so considered since their mean scores are below the 3.0 accepted index of agreement as earlier stated. Poor crew interaction or non-cordial relationship among crew members (3.79) was ranked first by respondents as the most frequent human-driven cause of marine accidents. Work fatigue (3.76) was ranked second while drugs and alcoholism (3.74) ranked third. Similarly, poor communication due to language barrier and multi-cultural crew, vessel over speed caused probably by drug and alcohol abuse and commercial pressure from management were ranked fourth, fifth and sixth respectively. Complicated work processes, gap in personnel working knowledge and deliberate unruly behavior of marine personnel were ranked seventh, eighth and ninth respectively. On the other hand, working condition, faulty judgment by crew members, improper handover and complacency were not considered as significant factors that cause accidents in Nigeria context. By implication, the result showed that the nine factors chosen by respondents in this study were the most common human behavioral factors that are likely to lead to incidents on Nigeria waters.

3.3. Relationship between human factors, safety culture and safety performance

Pearson correlation test was carried out between safety culture, safety performance and human factors that cause accidents in Nigeria maritime environment as shown in Table 3. The table shows the existence of positive relationships between safety culture and all human related accident-causing factors. However, significant relationship was established in five human factors namely: poor communication ($r = 0.211, p < 0.01$); vessel over speed ($r = 0.253, p < 0.01$); commercial pressure from management ($r = 0.156, p < 0.01$); complicated work processes ($r = 0.151, p < 0.05$) and deliberate unruly behavior ($r = 0.142, p < 0.01$). The relationship between the human related, accident-causing factors and safety performance was insignificant in all the measures except drugs and alcoholism ($r = 0.243, p < 0.01$), and crew fatigue ($r = 0.118, p < 0.05$).

3.4. Predictors of marine safety performance

Table 4 shows the summary of regression analysis used to determine the predictive power of the human factors on safety performance. The analysis also highlights the human behavioral variables that significantly predict changes in marine safety performance. In order to determine the relative contribution of independent variables (human factors) towards predicting change in safety performance as the dependent variable, multiple linear regression analysis was performed and result is also presented. In terms of the contributions of each independent variable toward predicting changes in the dependent variable, table 4 shows that five highlighted human errors (crew fatigue, drugs and alcoholism, vessel over speed, deliberate unruly behavior and faulty crew judgment) were significant with lower levels of safety in the maritime industry. Drugs and alcoholism ($beta = -0.295; t = -4.440; p < 0.01$) recorded the highest significant contribution towards predicting lower safety performance. This was followed by faulty crew judgment ($beta = -0.242; t = -2.388; p < 0.01$); deliberate unruly behavior ($beta = 0.235; t = 2.364; p < 0.05$); work fatigue ($beta = 0.151; t = 2.456; p < 0.05$); and vessel over speed ($beta = 0.144; t = 2.305; p < 0.05$). Table 4 also shows a moderate correlation coefficient of 0.38, implying that the overall strength of relationship between human factors and safety performance was relatively low. In addition, the coefficient of determination (R2) was 0.150 while the adjusted R2 was 0.112, showing that only 11.2% of the variation in safety performance can be explained by changes in the predictor variables (human factors). Furthermore, the overall fit of the model was low given an F-statistics of 3.987 at 5% critical level. The Durbin Watson (DW) statistic which measures the presence of serial correlation in the variables shows 1.630, indicating that a relatively small autocorrelation exists among the variables in the model; this is so given the acceptable DW value of 2.0. It is therefore concluded that though linear relationship exist between the dependent and independent variables of the model, the strength and fit of the relationship was relatively low.

3.5. Strategies for minimizing marine accident in Nigeria

Seafarers and crew members under study proffer suggestions on how to curb incidences of marine accidents on Nigeria territorial waters as shown in Figure 1. By dealing with the human driven errors, it is believed that cases of vessel accidents could be reduced. Majority of the respondents (93%) suggested putting in place company-wide policy to recognize and reward staff for strict compliance with safety standards. Similarly, 90% suggested increased staffing, training and retraining of ship crews while 85% suggested prompt reporting of unsafe acts. In addition, 65% of respondents opined that

Table 2: Distribution of respondents by socio-demographic characteristics

S/N	Human Factors	VF	F	SF	NVF	NF	Mean Score	SD	Rank
1.	Poor communication	66 (23.2)	116 (40.8)	73 (25.7)	21 (7.4)	8 (2.8)	3.74*	0.99	4
2.	Crew members fatigue	72 (25.4)	115 (40.5)	65 (22.9)	20 (7.0)	12 (4.2)	3.75*	1.04	2
3.	Complacency	37 (13.0)	70 (24.6)	53 (18.7)	58 (20.4)	66 (23.2)	2.84	1.37	12
4.	Drugs and alcoholism	83 (29.2)	101 (35.6)	61 (21.5)	23 (3.1)	16 (5.6)	3.75*	1.13	3
5.	Poor crew interaction	65 (22.9)	127 (44.7)	69 (24.3)	12 (4.2)	11 (3.9)	3.79*	0.97	1
6.	Gap in personnel working knowledge	50 (17.6)	97 (34.2)	77 (27.1)	50 (17.6)	10 (3.5)	3.45*	1.08	8
7.	Commercial pressure from management	67 (23.6)	100 (35.2)	89 (31.3)	20 (7.0)	8 (2.8)	3.70*	0.99	6
8.	Deliberate unruly behaviour	35 (12.3)	111 (39.1)	46 (16.2)	34 (12.0)	58 (20.4)	3.11*	1.35	9
9.	Faulty crew judgment	35 (12.3)	86 (30.3)	50 (17.6)	49 (17.3)	64 (22.5)	2.93	1.37	11Â
10.	Unsafe vessel speed	82 (28.9)	93 (32.7)	71 (25.0)	27 (9.5)	11 (3.9)	3.73*	1.09	5
11.	Complicated work processes	75 (26.4)	87 (30.6)	82 (28.9)	33 (11.6)	7 (2.5)	3.67*	1.06	7
12.	Dissatisfactory working condition	26 (9.2)	83 (29.2)	82 (28.9)	36 (12.7)	57 (20.1)	2.95	1.26	10
13.	Improper handover	25 (8.8)	81 (28.5)	75 (26.4)	45 (15.8)	58 (20.4)	2.89	1.26	13

** Significant; SD = Standard Deviation; VF = Very Frequent; F = Frequent; NVF = Not Very Frequent; NF = Not Frequent; SF = Somewhat Frequent*

Source: Field Survey, 2015

Table 3: Extract of Pearson correlation analysis between safety culture, safety performance and human causes of marine accidents

S/N	Variable	Correlation coefficient Sig. (2 tailed)	Safety culture	Safety performance
1	Poor crew interaction	r	0.095	-0.038
		p-value	0.112	0.520
2	Crew fatigue	r	0.081	0.118*
		p-value	0.173	0.047
3	Drugs and alcoholism	r	0.096	0.243**
		p-value	0.108	0.000
4	Poor communication	r	0.211**	0.055
		p-value	0.000	0.359
5	Unsafe vessel speed	r	0.253**	0.079
		p-value	0.000	0.186
6	Commercial pressure from management	r	0.156**	0.046
		p-value	0.008	0.437
7	Complicated work processes	r	0.151*	-0.004
		p-value	0.011	0.951
8	Gap in personnel working knowledge	r	0.040	-0.136
		p-value	0.507	0.022
9	Deliberate unruly behaviour	r	0.142*	-0.035
		p-value	0.016	0.562

*** Correlation is significant at the 0.01 level (2-tailed)*

** Correlation is significant at 0.05 level (2-tailed)*

Source: Field Survey, 2015

Table 4: Linear regression analysis on contribution of human factors to predicting safety performance

Variable	Beta Estimate	Standard Error	t-value	p-value
(Constant)	30.384	1.455	20.881	0.000
Poor communication	0.048	0.265	0.731	0.466
Crew fatigue	0.151	0.234	2.456	0.015
Drugs and alcoholism	-0.295	0.233	-4.440	0.000
Poor interpersonal interaction	0.033	0.266	0.500	0.617
Gap in staff working knowledge	-0.094	0.255	-1.343	0.180
Commercial pressure from management	0.036	0.248	0.570	0.569
Vessel over speed	0.144	0.226	2.305	0.022
Complicated work process	0.063	0.255	0.923	0.357
Complacency	-0.014	0.198	-0.205	0.838
Deliberate unruly behaviour	0.235	0.293	2.364	0.019
Faulty crew judgment	-0.242	0.293	-2.388	0.018
Improver handover	-0.102	0.221	-1.446	0.149
R	0.387			
R^2	0.150			
Adjusted R^2	0.112			
Standard Error	3.73251			
Durbin Watson	1.630			
F value	3.987			

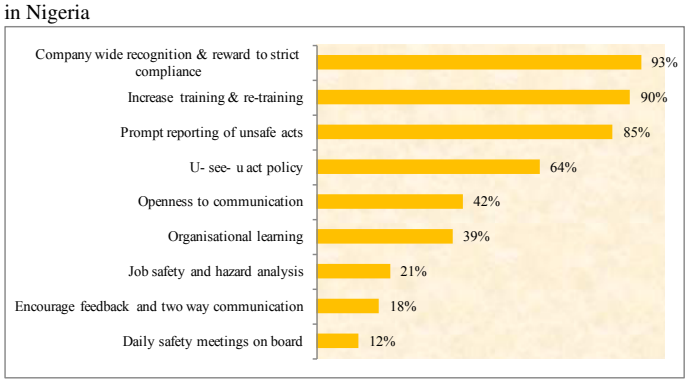
Source: Field Survey, 2015

using a 'U-See- U-Act' (hazard hunt programmer) strategy is gainful. 'U-See- U-Act' is a strategy of reporting noticeable incidents and accidents at any time no matter how small on a form or card provided by the organization. These written hazards or potential hazards are shared among crew and stewards until they are addressed. Furthermore, 42% suggested openness to communication from management and staff, 39% suggested organizational learning - a continuous improvement on safety policies, procedures and regulations and 21% recommended frequent job safety/hazard analysis. Moreover, while 18% suggested encouragement of feedback and two way communication of human errors, 12% of respondents recommended daily safety meeting and tool box talk to be part of ship crew programmers. Apart from the above, other suggestions made through the open section of questionnaire include: use of incidence report card, regular checks of onboard safety equipment, job intervention programmed/stop work authority, accident investigation matrix, regular blood alcohol concentration test, monetary incentive, step back 5x5 strategies and last minute risk assessment before commencing any task.

4. Discussion

The study showed that nine (9) human related factors were identified as major causes of accident; viz: poor crew interaction, crew fatigue, drugs and alcoholism, unsafe vessel speed, commercial pressure from management, complicated work processes, gap in working knowledge, faulty crew judgment and deliberate unruly behavior. Out of the nine (9) important human errors, five (5) of them: crew fatigue, drugs and alco-

Figure 1: Respondents' opinion on measures of minimizing marine accidents in Nigeria



Source: Field Survey, 2015

holism, unsafe vessel speed, faulty crew judgment and deliberate unruly behavior; were significant in predicting safety performance, which is defined as the extent or frequency of marine incident occurrence. Other factors responsible were negligence of watch keeping, careless fixing of ship's position, poor preparation to departure, poor response to adverse weather conditions and negligence of lookouts. These results have found support in previous studies examining human factor determinants of marine accidents (Ross, 2004; Xavier and Nikolas, 2009; Dogarawa, 2012). There existed a significant positive relationship between safety culture and five human-related accident-causing factors; namely: poor communication, vessel over speed, commercial pressure from management, complicated work processes, deliberate unruly behavior. This is consistent in part with studies by (Pyne and Koester, 2005; Houtman, 2007) and (Ramachand et al., 2009) (Pyne and Koester, 2005)(p.4) argued that 'poor communication between crewmembers who are not speaking the same language can, through misunderstandings and mistakes, be a threat to the overall safety of a vessel.' Furthermore, the more conscious individuals are about these factors and their readiness to address them in daily work, the more improved the safety culture in the organization. Mariners can cultivate safety culture by avoiding deliberate unruly behavior at sea. Such wilful behavior may include dangerous overtaking, unsafe vessel speed, wrong use or non-usage of sound signals in restricted visibility areas, improper look out and not observing collision regulations etc. Thus, having positive and robust safety culture in place is capable of addressing issues associated with the five significant human driven safety risks identified in this study (Efiok et al., 2015). Thus, safety performance at sea could be achieved when drug usage and alcohol abuse is minimized and when issues of crew fatigue is addressed with purposeful institutional safety policies. Findings also showed that recognizing and rewarding staff with impressive records of safety is a sure way to improving safety performance and reducing accidents in Nigeria maritime industry. Other measures include staff training, openness to communication, proper feedback mechanism, safety/hazard analysis, daily safety meeting, prompt incidence reporting, stiff punishment to defaulters and regular checks on drugs and substance abuse etc. Similar views and measures were shared in studies by (Howland et al., 2001; Catherine and Kathryn, 2006) and (Ramachand et al., 2009).

5. Conclusion And Recommendations

Accident is a common phenomenon. It does not segregate on the basis of time and place of occurrence. Whether on land, sea or air, the consequences are devastating, sometimes claiming lives, causing personal injuries and pains, damaging valuable cargoes and reputation of the organization involved. The focus of this study was to investigate the human factors as determinants of accidents at sea, with Nigeria maritime industry as the unit of analysis. The conclusion drawn from this study is that several human errors are contributory causes of marine accidents on Nigeria navigational waters. These include: poor crew interaction, crew fatigue, drugs and alcoholism, unsafe vessel speed, commercial pressure from management, complicated work processes, gap in working knowledge, faulty crew judgment and deliberate unruly behavior. Others include negligence of watch keeping, careless fixing of ship's position, poor preparation prior to departure, deficient response to adverse weather and negligence of lookouts. This study made significant contributions to marine safety management by identifying various interventions and initiatives ship owners and maritime policy makers can bring on board to enhance safety performance. It is therefore recommended that adequate lines of formal and informal communication between ship owners, crew members and dock workers be open to reduce the number of groundings and collision and enhance safety culture. In addition, maintaining a system of feedback on safety errors and support for safety implementation by management is capable of drastic reduction in marine incidents. It is also important to combat seafarers fatigue through effective system of watch keeping, enough rest after work hours, making marine task lively, reducing monotony and boredom should be part of the programmer. Furthermore, implementation of 'Marine Safety Performance Plan,' which is part of the International Safety Management (ISM) Code could reduce marine accidents. In order to solve the problem of poor crew communication and interpersonal relationship, teamwork and regular review meetings between crew members and other deck officers should be encouraged. The importance of safety in maritime industry warrants that the human elements should be given serious attention in Nigeria and beyond.

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