



Safety Management of Lighter Barges for Prevention of Incidents and Accidents around Lagos Rivers and Creeks

Sule Abiodun

Research Scholar, Niomr Research Lagos, Nigeria

Abstract

The switch of shipment from large vessels to lighter barges is done in deep water, preferably in rather calm waters. The switch operation makes use of cranes, which are usually fixed to the lighter barge, but may be operated differently from the barge on a more permanent offshore platform. It is important to note that sometimes accident occurs in the process leading to loss of lives and property. This study investigated safety management of lighter barges for prevention of incidents and accidents around Lagos rivers and creeks. Descriptive survey was carried out and the selected respondents for the study included operators, crew members and regulators and other mariners selected from among employees working on vessels belonging to two Nigerian shipping companies, Safmarine Nigeria and PIL Nigeria limited. The sample size was selected using purposive sampling technique and a self-made, structured questionnaire was adopted for data collection. The study was guided by three objectives, one broad research question and a set of null and alternative hypotheses. The Actual sample of the study was 448. The hypothesis formulated was tested using Chi-Square at 0.05 level of significant whereas the data was analyzed descriptively using means. The results listed out some of the most frequently occurring accident around Lagos rivers and creeks, suggested how these accidents could be eliminated while indicating how safety management practices of lighter barges prevents incidents and accidents around Lagos rivers and creeks. Based on the findings, conclusions were made and recommendations suggested.

Keywords: Safety management, lighter barges, preventions, incidents, accidents

1 Introduction

The development of inland waterway transport can be obstructed by certain navigation conditions such as shallow water, narrow fairways and ice as only small ships with relatively high unit cost can be serviced. The use of barges is a possible solution as they are adjusted to specific navigable conditions to increase efficiency and/or loading capacity compared to standard equipment (Lantz et al., 2016). Lighter barges are flat-bottomed with container handling cranes and are either tug or self-powered. The barges are constructed to transport cargo from larger ships into and out of shallow ports. The amount of cargo carried by lighters depends on the size of the lighter. The most draft when absolutely loaded is below 40-feet. The switch of shipment from large vessels to lighter barges is done in deep water, preferably in rather calm waters. The switch operation makes use of cranes, which are usually fixed to the lighter barge, but may be operated differently from the barge on a more permanent offshore platform (Bingham, Cyr & Cahoon, 2016).

2 Problem statement

For quite a number of years, the problems related to boat injuries have not been well emphasized. Water transportation in Nigeria has undergone serious infrastructural and human capacity neglect, a situation that propelled boat mishaps and increased mortality rate all over the country. Agencies such as National Inland Waterways Authority (NIWA) saddled with the duty of managing the water ways has been inadequately funded and mismanaged. Equipment deployed to oversee such water ways are outdated and employees are not skilled enough to man the facilities. Many people in their productive years have died due to boat mishaps resulting from incompetence in administration and employees, as well as many goods lost in recent times (Nwankwo&Ukoji 2015). While the perilous nature of water transportation in Nigeria is not limited to managerial

incompetence and unskilled manpower ineptitude, the lack of knowledge of boat riders and passengers in safety measures is worse. Boat riders rely on their overrated knowledge of the water channels to convey passengers and goods to various places without sufficient training and certification in safety measures and navigational techniques. Boat mishaps are made worse when boats are loaded with more goods and passengers than required. The passengers also refuse to adhere to safety measures and mostly decline the use of life jackets when aboard. Technology and safety protocols have improved in recent years, but barges remain a relatively hazardous workplace. That is why preventing accidents and injuries is one of the top priorities of most barge workers, operators, and captains. Proper government agencies may investigate the circumstances of barge accidents when they occur in order to establish a cause. Accidents can result in life-threatening injuries and even death and as such, safety precautions should be taken seriously and be followed judiciously.

The main aim of this paper is to investigate how safety management of lighter barges aids in prevention of incidents and accidents around Lagos rivers and creeks. Specific objectives are:

1. To identify possible accidents that can occur in lighter barges around Lagos rivers and creeks
2. To identify safety management practices of lighter barges for prevention of incidents and accidents around Lagos rivers and creeks
3. To determine how safety management of lighter barges prevents incidents and accidents around Lagos rivers and creeks

3 Research questions

To what extent does safety management of lighter barges aid in prevention of incidents and accidents around Lagos Rivers and creeks?

4 Hypothesis

1. H0: Safety management of lighter barges does not prevent incidents and accidents around Lagos rivers and creeks
2. H1: Safety management of lighter barges does prevent incidents and accidents around Lagos rivers and creeks

5 Literature Review

A typical day's work on a barge, like all maritime work is full of potential hazards. Equipment failure, cargo mishaps, fires and collisions are just a few of the barge accidents that could result in serious injury or even death for a barge worker (Schooley, 2020). A kind of vessel ordinarily used for transporting cargo is called a barge and is not like independent vessels or boats but are floating vessels usually towed or tugged alongside other vessels. Like a raft, it is flat shaped on its bottom and the reason for this shape is to certify that the cargo-carrying capacity is intensified, and greater bulk may be hauled and conveyed (Bhuvan, 2020).

A barge is a kind of vessel which is mainly used to convey cargo and have to be tugged or towed alongside other naval vessels in the water because they are not independent (Bhuvan, 2020). They are mostly used in smaller water bodies such as rivers, lakes and canals; though they are now well used at seaports.

Maritime in Nigeria

The state of Lagos is denoted by a mesh of lagoons and waterways, which makes up approximately 22% of the State's territory. The main bodies of water include Lagos and Lekki Lagoons, Yewa, Oshun, Ogun and Kweme Rivers. Also, Ologe Lagoon, Kuramo Waters, and Badagry, Five Cowries and Omu Creeks respectively. Lagos State Waterways (LASWA) is responsible for the coordination and management of reforms that ensure the long term growth and development of water transportation in the state as well as granting of ferry licenses and concessions for ferry routes and terminals operations to the private sector (LASWA, 2017).

In Lagos, Nigeria, the Nigerian Maritime Administration and Safety Agency, NIMASA, is devoted to the induction of excellent universal practices to provide maritime services with focus including effective Maritime Safety Administration, Training and Certification of Seafarers, Maritime Labour Regulation, Search and Rescue, Marine Pollution Prevention and Control, Cabotage enforcement, Shipping Development and Ship Registration, and Maritime Capacity Development. With the use of modern tools that ensure efficacy and outright performance, they are determined to develop indigenous capacity and eliminate all hindrance. Barges to be deployed are certified for seaworthiness by NIMASA. Also, the National Inland Waterways Authority (NIWA) was established with the primary responsibility to improve and develop Nigeria's inland waterways for navigation as well as improve and develop inland waterways for navigation, provide an alternative mode of transportation for the evacuation of economic goods and persons and execute the objectives of the national transport policy as they concern inland waterways (NIWA 2021).

Accidents that can occur in lighter barges

Barges, which are of great importance to the economy of the nation are also prone to accidents. While on-the-job hazards are a reality for maritime workers (Schooley, 2020), there are different ways crew members can ensure their safety and prevent injuries in these accidents:

Slipping, tripping, and/or falling: a major cause of workplace injuries on and off the water are slip, trip, and fall accidents. These accidents can be drastically reduced when crew members endeavor to keep all surfaces, both walking and working, dry, clean and free. This includes proper storage of gear and equipment when not in use; ensuring that the decks and other walkways are well lit; keeping all decks, stairs and walkways free of water, rubble and ice; also securing ramps during processes of loading and offloading. Decks can get wet often because they are located

near the waterline and as a result it is common for slips and falls to occur. When properly maintained, coupled with using the right protective equipment and ensuring safety practices, accidents can be drastically cut down. Falling overboard: hypothermia and even drowning can result from a fall overboard. If a safety compliant railing system is not installed on a barge, workers are always required to wear personal flotation devices. There should be “man overboard” rescue procedures, a standby rescue craft, training drills and classes life rings connected to at least 90feet of rope and rescue ladders that extend below water in case of a fall overboard.

Barge accidents for workers in enclosed spaces: an enclosed which is a space that has limited openings for entry and exit, unfavourable natural ventilation, and that is not designed for continuous worker occupancy has any of the following characteristics: limited openings for entry and exit; inadequate ventilation; and is not designed for continuous worker occupancy (OCIMF 2019). Some examples are cargo spaces, fuel tanks, ballast tanks, cargo compressor rooms, cargo pump rooms, cofferdams, void spaces, sewage tanks etc. Working in confined or enclosed spaces is a part of working aboard a barge and some hazards include oxygen deficiency, atmospheres containing toxic compounds and explosive or flammable vapors. Crew members need to carry out thorough visual inspection of these areas for possible hazards as well as testing the atmosphere work commencement, to prevent being caught in them. Heavy machinery-related accidents: The operation, loading, and unloading of barges requires a significant amount of heavy machinery. Barge accidents can occur when this machinery suddenly breaks down, works improperly or even when barge workers are performing maintenance or repairs on heavy machinery. Many barges operate with cranes or other heavy lifting mechanics, which can present their own hazards in the event of an accident.

Fires and explosions: several barge workers are injured and killed by fires and explosions each year. Some of the steps that can be taken to reduce the danger of fire or explosion such as:

- -proper storage of compressed gas tanks and fuel tanks.
- -adhering to proper safety precautions when grinding, cutting welding, drilling or doing other “hot” jobs.
- -wearing the right personal protection equipment provided
- -having proper fire extinguishing equipment on hand
- -shielding tanks and fuel sources from potential ignition sources.

Some types of barges have a heightened danger of fire outbreaks such as jack-up barges which are deployed specially for oil drilling and exploration purposes and freight barges which are often tasked with transporting flammable materials. Flammable vapours not properly vented can result in fire-related accidents.

Hazardous environment accidents: Barges can be loaded with a wide variety of materials. In some cases, hazardous materials can be the reason for accidents and sometimes maritime workers may suffer from hypoxia stemming from working in environments with low-oxygen. Barge accidents linked to hazardous materials or environments can cause serious injuries. Improperly maintained or used equipment: when equipment are not properly used and maintained, it can cause a number of barge accident injuries. Barge workers should inspect all equipment and machinery before using them to reduce the risk of injuries relating to equipment accidents. There should be proper maintenance of equipment and machinery and an assurance that all persons using them are properly trained in their use and maintenance. When working around cranes, hoists and winches including other types of moving machinery, crew members should be extremely careful.

Bhuvan (2020) listed the following as some common uses of marine barges:

- For successful transport of bulk items.
- For travel in calm water, either upstream or downstream, using self-propelled barges which can propel on their own and facilitate successful movement of any kind of cargo (either dry or liquid).
- For inter-state transportation of grain and coal as save a huge sum in transportation while the same is to be carried by any other mode.

Safety management in lighter barges

A risk assessment process which identifies hazards present in a work undertaking, analyses the level of risk, considers those in danger and evaluates whether hazards are adequately controlled, considering any measures already in place.

The safety officer, who preferably should be an experienced seafarer, is to inspect all areas of the vessel on a regular basis for safety compliance and to report any deficiencies noted.

The crew must be aware of the requirements for wearing personal protective equipment such as boiler suits, safety harnesses, safety footwear, eye and ear protection, respiratory and chemical protective equipment (OCIMF, 2019).

Trainings and drills: crew must be regularly trained in the use of life-saving equipment as well as familiar with the location and operation of fire and safety equipment and with their duties in the event of an emergency.

Lifesaving equipment: these should be available, in good working condition, correctly located and ready for use.

Fire Fighting Equipment: Fire-fighting systems and appliances must be kept in good working order and readily available for immediate use. Portable extinguishers which have been discharged should be immediately recharged or replaced with an equivalent unit; all fire detection and alarm systems, pumps and hoses, fire mains, nozzles and isolating valves should be in good working conditions (OCIMF, 2019).

Previous research

Psarafitis et al (1998) conducted a comprehensive analysis of the human element as a factor in marine accidents. The object was to investigate relationship between the various probable causes of an accident and the outcome of the accidents. The study revealed that factors linked to human errors are the single most common reason why marine accidents occur. Talley (2002) in a related study of towboat vessel accidents discovered that the number of fatal and non-fatal accidents in total is greater for docked or moored vessels than for underway vessels; and for fire/explosion accidents than for other types of accidents.

Similarly, Nwankwo&Ukoji (2015) reviewed the general trend and risk factors of boat accidents in Nigeria using data from Nigeria Watch and discovered that in boat accidents totaling 180 from June 2006 to May 2015, a total of 1607 lives were lost. Natural and human related causes of such fatal boat accidents were discovered to include overloading, stormy weather, reckless driving, piracy, militancy, carelessness, political instability and wreckages. Findings revealed that fatalities spread among government security personnel including the Nigerian Navy, Army, boat operators and passengers, barge captains, militia groups and pirates and also that the amnesty program initiated in 2009 in the Niger Delta area contributed to the reduction in the number of boat accident fatalities in 2010 but the dissatisfaction in the management of the program among the different armed groups led to a resurgent of boat accident particularly in the Niger Delta waterways.

Furthermore, Nwoye et al. (2019) studied the safety hazards and practices existing in the inland water transportation sector in some states of southern Nigeria and concluded that a wide range of maritime safety hazards and practices troubled the inland water transportation sector in Nigeria. Findings showed that the use of inefficient boat operators was the most existing maritime hazard in the study area, because it ranked highest while non-compliance to alcohol and drug policies by operators, no use of journey management forms and safety briefs rarely conducted before departure were the highest ranked unsafe practices respectively.

6 Theoretical framework

Reason's Swiss Cheese model originally proposed in 1990 is related to this study. According to this theory, there is potential for failure in every stage in a process (Reason, 2003). Each layer of defense is represented by a slice of Swiss cheese, and the possible problems or failures in that defense are represented by the holes in the cheese. There are two types of failures that can occur which are active and latent. Active failures are unsafe acts that directly contribute to an accident while latent failure are conditions that exist but may lay inactive for a period until they result in an accident. For instance, a policy that addresses work could be the first layer of a process and the next layer could be requirement to wear personal protective equipment (PPE) to complete the task. If the policy does not address the PPE, or requires the wrong one, the problem moves from that line of defense and through the first hole. The choice of not wearing the PPE or wearing the wrong one allows passage through the next hole. If there are no other layers of defense, these conditions will allow an accident to occur. In other words, small holes in each layer allows for some possibility that the defense will not be effective and if the circumstances are right, these holes can align and let an accident occur.

7 Methodology

The study adopted a descriptive survey on prospective respondents who cut across operators, crew members and regulators and other mariners selected from among employees working on vessels belonging to two Nigerian shipping companies, Safmarine Nigeria and PIL Nigeria limited - both located in Apapa area of Lagos State, Nigeria. A purposive sampling technique was adopted in selecting the sample which was based on the respondents' availability at the time of the study, their knowledge of the subject matter, and above all, their willingness to take part in the study. A self-made questionnaire was developed for the study which was structured in line with the research objectives proposed in the study. The questionnaire adopted the 4point format of Likert scale of Strongly Disagree (SD=1), Disagree (D=2), Agree (A=3), Strongly Agree (SA=4). Sampling size was determine using simple random sampling technique with which 465 questionnaire was administered to the prospective respondents while they were at work, but only 448 questionnaire were considered valid and duly answered and returned. In this sense, the analysis was based on the actual sample returned. The hypothesis formulated was tested using Chi-Square at 0.05 level of significant whereas the data was analyzed descriptively using means and simple percentages. The decision rule which determine whether or not an item is accepted as true was based on the fact that the means of the item must be 2.5 and above, if otherwise, then reject.

8 Results and Findings

Table 1: Respondents opinions on possible accidents that can occur in lighter barges around Lagos rivers and creeks

Items	SA 4	A 3	D 2	SD 1	Total (SA*4) + (A*3)	Means \bar{x}	Decision To accept ≥ 2.5
Personal injuries due to slips, trips and falls	311	137	0	0	1655	3.7	Accepted
Inhalation of toxic fumes in enclosed spaces can cause death	199	244	0	5	1533	3.4	Accepted
Drowning can result from a fall overboard	273	89	67	17	1512	3.4	Accepted
Severe burns and even death can result from fires and explosions	325	96	17	10	1632	3.6	Accepted
Lifting heavy machines can cause fractures and even crush limbs of operators when they fall on them	397	33	16	2	1721	3.8	Accepted

Items in table 1 were structured to identify possible accidents that can occur in lighter barges around Lagos rivers and creeks. Based on the analysis carried out, the Mean statistical tool adopted in the study had a cut-off mean score of 2.5 to determine whether or not an item is accepted or otherwise. As indicated in the Table, all five items have their mean that is above 2.5. As a result all the items were accepted. This shows that some frequently occurring incidents and accidents around Lagos rivers and creeks are: Personalinjuries due to slips, trips and falls with a mean score of 3.7 (accepted); Inhalation of toxic fumes in enclosed spaces can cause death with a mean score of 3.4 (accepted);Drowning can result from a fall overboard with a mean score of 3.4 (accepted); Severe burns and even death can result from fires and explosions with a mean score of 3.6 (accepted) and Lifting heavy machines can cause fractures and even crush limbs of operators when they fall on them with a mean score of 3.8 (accepted).

Table 2: The opinion of the respondents on safety management practices of lighter barges for prevention of incidents and accidents around Lagos rivers and creeks

Items	SA 4	A 3	D 2	SD 1	Total (SA*4) + (A*3)	Means \bar{x}	Decision To accept ≥ 2.5
A safety officer inspects all areas of the vessel and reports deficiencies on a regular basis	300	137	6	5	1611	3.6	Accepted
Every crew member is mandated to wear personal protective equipment	197	240	5	7	1508	3.3	Accepted
Lifesaving equipment are available, in good working condition and ready for use	270	92	67	17	1356	3.2	Accepted
Drills and training are done regularly	325	96	17	10	1632	3.6	Accepted
Extinguishers, appliances and systems to prevent and fight fire are available for immediate use	390	40	16	2	1680	3.8	Accepted

Table 2 presents the respondents opinion on safety management practices of lighter barges for the prevention of incidents and accidents around Lagos rivers and creek. Going by the items in the table, and the mean responses of the items were above 2.5 implying that all items were accepted. Thus, we conclude that, some safety management practices around Lagos rivers and creeks include: A safety officer inspects all areas of the vessel and reports deficiencies on a regular basis; Every crew member is mandated to wear personal protective equipment; Lifesaving equipment are available, in good working condition and ready for use; Drills and training are done regularly; andExtinguishers, appliances and systems to prevent and fight fire are available for immediate use, respectively.

Table 3: The respondents' opinions on how safety management of lighter barges prevents incidents and accidents around Lagos rivers and creeks

Items	SA 4	A 3	D 2	SD 1	Total (SA*4) + (A*3)	Means \bar{x}	Decision To accept ≥ 2.5
Regular trainings and drills help crew members familiar with their duties in the event of an emergency	273	89	67	17	1512	3.4	Accepted
Risk assessment helps in identification of hazards that can cause incidents and accidents	325	96	17	10	1632	3.6	Accepted
Personal protective equipment protects against hazards and reduces impact of any	397	33	16	2	1721	3.8	Accepted
Availability and knowledge of use of emergency equipment in cases of fire can help prevent a major accident	317	99	23	9	1620	3.6	Accepted

Table 3 presents the respondents' views on how safety management of lighter barges prevents incidents and accidents around Lagos rivers and creeks. According to the result presented in the above, all the means scores are above the benchmark ≥ 2.5 indicating that: Regular trainings and drills help crew members familiar with their duties in the event of an emergency; Risk assessment helps in identification of hazards that can cause incidents and accidents; Personal protective equipment protects against hazards and reduces impact of any; and Availability and knowledge of use of emergency equipment in cases of fire can help prevent a major accident.

Hypothesis

H0: Safety management of lighter barges does not prevent incidents and accidents around Lagos rivers and creeks

H1: Safety management of lighter barges does prevent incidents and accidents around Lagos rivers and creeks

The Chi square table below indicates that the P-value is 0.049 which is less than the critical value of 0.05% thus we reject the null hypothesis. This implies that Safety management of lighter barges does prevent incidents and accidents around Lagos rivers and creeks

Table 4. Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.390 ^a	15	.049
Likelihood Ratio	9.800	15	.032
Linear-by-Linear Association	.036	1	.049
N of Valid Cases	60		

a. 19 cells (79.2%) have expected count less than 5. The minimum expected count is .13.

This result was further strengthened by the symmetric measures as indicated in the table below. In the table, the Spearman correlation result has a P-value of 0.0306 which is less than the significant level of 0.05. Thus, we reject the null hypothesis indicating that Safety management of lighter barges does prevent incidents and accidents around Lagos rivers and creeks.

Table 6: Symmetric Measures		Value	Asymp. Std. Error ^a	Approx. T ^b	Approx. Sig.
Interval by Interval	Pearson's R	.014	.033	.411	.0481 ^c
Ordinal by Ordinal	Spearman Correlation	.013	.033	.377	.0306 ^c
N of Valid Cases		849			
a. Not assuming the null hypothesis.					
b. Using the asymptotic standard error assuming the null hypothesis.					
c. Based on normal approximation.					

9 Discussion

This study investigated the safety management of lighter barges for prevention of incidents and accidents around Lagos rivers and creeks. Guided by three research objectives the study specifically tested whether or not safety management of lighter barges will prevent incidents and accidents around Lagos rivers and creeks. The result from this study revealed that Safety management of lighter barges does prevent incidents and accidents around Lagos rivers and creeks. It is no doubt that mariners are exposed to unlimited number of accident which can occur at any point and endanger lives as much as possible (Schooley, 2020). Some of these accidents as presented in Table 1 below include: A safety officer inspects all areas of the vessel and reports deficiencies on a regular basis; Every crew member is mandated to wear personal protective equipment; Lifesaving equipment are available, in good working condition and ready for use; Drills and training are done regularly; and Extinguishers, appliances and systems to prevent and fight fire are available for immediate use, respectively. This result is in harmony with those mentioned in Montagna (2020) as common incidents and accidents associated with barges. Similarly, the study supports the study by Nwankwo and Ukoji (2015) who also listed out some different types of accidents/incidents that are peculiar in barges generally. By implication, Lagos rivers and creeks suffer similar accidents as those experienced in other states and countries.

Having proven that several accidents occur in little barge, there is the need for safety management practices of lighter barges with the aim of preventing incidents and accidents, especially around Lagos rivers and seas. It is no doubt that when transferring cargoes from one ship to another, there is every tendency that accident may occur and to minimize the rate of accident, the following measures, as mentioned in Table 2 above including: A safety officer inspects all areas of the vessel and reports deficiencies on a regular basis; Every crew member is mandated to wear personal protective equipment; Lifesaving equipment are available, in good working condition and ready for use; Drills and training are done regularly; and Extinguishers, appliances and systems to prevent and fight fire are available for immediate use, respectively. These result correspondents with some of the stated rules and regulation specifically meant to guide safety management in rivers and creeks (barges). For instance, the U.S. Coast Guard established rules and regulation from different aspects of barge activities. Some of these regulations are: those meant to uninspected vessels (Code of Federal Regulations, 46 CFR Part 25); those connected with employee working (OSHA regulations that apply are in 29 CFR Part 1910); regulations that are connected with ship repair, shipbreaking, and shipbuilding are found in 29 CFR Part 1915 standards; those applicable to long-shoring and cargo handling operations are presented in 29 CFR Part 1918 and 29 CFR Part 1919 standards while those associated with marine construction activities are found in 29 CFR Part 1926 as well as those listed in OSHA Academy (2017), REPSOL, S. A., (2014), and ABS (2005) respectively.

Finally, the result revealed some safety management of lighter barges and their impacts in preventing incidents and accidents around Lagos rivers and creeks. With a mean score above 2.5, the following were indicated: Regular trainings and drills help crew members familiar with their duties in the event of an emergency; Risk assessment helps in identification of hazards that can cause incidents and accidents; Personal protective equipment protects against hazards and reduces impact of any; and Availability and knowledge of use of emergency equipment in cases of fire can help prevent a major accident. This shows that some of the practices on different occasions have great implication in preventing incidents and accidents around Lagos rivers and creeks as indicated above.

10 Conclusion and recommendations

Based on the findings of this study, we conclude that incidents and accidents can easily occur around Lagos rivers and creeks; however, these can be prevented or completely eradicated by simply adopting some laid down safety management practices. This way, the number of accident issues will be greatly minimized. As a result, this study recommends daily services of vessels before setting off for any voyage. The study also recommends that vessels should be properly maintained and the crew member must take on safety measures to ensure their safety. There should be regular training of crew members on personal safety conscious.

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APPENDIX**SAFETY MANAGEMENT OF LIGHTER BARGES FOR PREVENTION OF INCIDENTS AND ACCIDENTS IN RIVERS AND CREEKS IN LAGOS****REQUEST FOR INFORMATION**

Dear Respondent,

I am carrying out a research on how safety management of lighter barges prevent incidents and accidents in creeks and rivers in Lagos state, and you have been chosen to be part of the study. This questionnaire is only for academic purpose; it will not be used for any other purpose not otherwise stated. Kindly select the response which applies to you. All information will be kept confidential.

Kindly tick the appropriate column which correctly reflects the extent to which you agree/disagree with the statements. The keys to the columns are as follows:

SA= Strongly Agree, A= Agree, D= Disagree, SD= Strongly Disagree

S/N	ITEMS	SA	A	D	SD
RQ1	What possible accidents that can occur in lighter barges around Lagos rivers and creeks?				
1	Personal injuries due to slips, trips and falls				
2	Inhalation of toxic fumes in enclosed spaces can cause death				
3	Drowning can result from a fall overboard				
4	Severe burns and even death can result from fires and explosions				
5	Lifting heavy machines can cause fractures and even crush limbs of operators when they fall on them				
RQ2	What are the safety management practices of lighter barges for incident and accident prevention around Lagos rivers and creeks?				
6	A safety officer inspects all areas of the vessel and reports deficiencies on a regular basis				
7	Every crew member is mandated to wear personal protective equipment				
8	Life saving equipment are available, in good working condition and ready for use				
9	Drills and training are done regularly				
10	Extinguishers, appliances and systems to prevent and fight fire are available for immediate use				
RQ3	How does safety management of Lighter barges prevent incidents and accidents				
11	Regular trainings and drills help crew members familiar with their duties in the event of an emergency				
12	Risk assessment helps in identification of hazards that can cause incidents and accidents				
13	Personal protective equipment protects against hazards and reduces impact of any				
14	Availability and knowledge of use of emergency equipment in cases of fire can help prevent a major accident				