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ASSESSING SHIP-BASED ACCIDENTS ON FERRIES IN THE NIGER DELTA

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ABSTRACT

This study focused on Assessing Ship-Based Accidents on Ferries in the Niger Delta. Maritime transport is a vital component of global trade and connectivity, facilitating economic activities and social interactions across continents, nations, and local communities. Despite the vital role of water transportation in facilitating economic activities and fostering regional connectivity in the Niger Delta, the sector is plagued by a concerning prevalence of ship-based accidents on boats and ferries. Among others, the objectives of this study include evaluating the primary causes of ship-based accidents on ferries in the Niger Delta as well as to uncover measures that can be implemented to mitigate ship-based accidents in the Niger Delta. The anchor theory of this research is the Systems-Theoretic Accident Model and Processes (STAMP), and the study adopted a survey research design. Descriptive statistics such as percentage frequency and econometric tools such as the Ordinary Least Squares regression technique was used in the analysis of the data sourced from the questionnaire. From the results of the study, the primary causes of ship-based accidents such as collision with vessels or obstacles, navigation errors, etc. are significant and have substantial negative socio-economic effects in the Niger Delta region. The study thus recommends, among other policy recommendations, that regulatory bodies should enforce strict compliance with safety protocols and regulations. This includes regular inspections of ferry vessels to ensure they meet safety standards, proper documentation of maintenance activities, and penalties for non-compliance.

Keywords: Ship-Based; Accidents; Ferries; Niger Delta

1.0 INTRODUCTION

In recent years, the Niger Delta and coastal regions of Nigeria have witnessed a concerning rise in ship-based vessel accidents, resulting in personal injuries, fatalities, and substantial damage to property and the environment. This escalation in accidents correlates with the surge in vessel traffic, particularly driven by oil prospecting activities and other commercial seaborne transportation ventures. For instance, findings from Dogarawa (2012) revealed alarming statistics spanning the years 2000 to 2009, indicating a total of five hundred and fifty-two (552) fatalities attributed to marine ferrying vessels and boat capsizing or collisions in Nigeria's inland waters. This data underscores an average fatality rate of approximately 55 deaths per year, underscoring the pressing safety concerns prevalent in the country's coastal and inland waterways over the past decade. An analysis of the investigated cases suggests several factors contributing to these accidents, including overloading of vessels, excessive speeding, inadequate attention to weather conditions, presence of abandoned wrecks obstructing navigation channels, operator incompetence, and insufficient navigational aids. These anecdotal observations shed light on the multifaceted nature of the challenges facing maritime safety in the region. The combination of these factors poses significant risks to both human life and marine ecosystems, highlighting the urgent need for comprehensive measures to address and mitigate the underlying causes of ship-based accident casualties. As documented by various researchers, such as Ukoji and Ukoji (2015) as well as Akpudo (2021), the utilization of these rivers and water bodies for transportation purposes has been a longstanding tradition in Nigeria. Oceanic, coastal, and inland water transport constitute the primary modalities, facilitating the movement of both goods and passengers across the nation. Notably, coastal waterways serve as vital conduits for transporting goods, where cost-efficiency often supersedes speed considerations. Despite the vital role of water transportation in facilitating economic activities and fostering regional connectivity in the Niger Delta, the sector is plagued by a concerning prevalence of ship-based accidents on boats and ferries. According to Lawal (2012), these accidents have inflicted significant human and economic costs, resulting in loss of lives, injuries, and damage to property. The frequency and severity of these incidents underscore a pressing need to address the underlying factors contributing to maritime safety risks within the region. One of the primary challenges exacerbating ship-based accidents on ferries in

the Niger Delta is the lack of adequate regulatory oversight and enforcement mechanisms. Regulatory agencies tasked with overseeing water transportation, such as the National Inland Waterways Authority (NIWA), face systemic challenges, including underfunding, insufficient personnel, and outdated monitoring equipment. Consequently, there is a gap in regulatory compliance and safety standards among ferry operators, leading to increased risks of accidents and mishaps (Akpudo, 2021). Beyond managerial shortcomings and personnel deficiencies, the pervasive lack of awareness among boat riders and passengers regarding safety protocols compounds the risk (Ukoji and Ukoji, 2015). Ferry operators often rely solely on personal familiarity with water channels, lacking formal training and certification in safety measures and navigational techniques. Furthermore, vessels are frequently overloaded, amplifying the likelihood of accidents. Passenger non-compliance with safety measures, notably the reluctance to utilize life jackets during journeys, further heightens the risk of casualties. Additionally, the inherent vulnerabilities of ferry operations, including overcrowding, inadequate maintenance, and poor navigational practices, exacerbate the risk landscape within the Niger Delta waterways. Overloaded ferries, coupled with a lack of adherence to safety protocols by both operators and passengers, create a conducive environment for accidents to occur. Addressing these systemic challenges requires a multifaceted approach, encompassing regulatory reforms, capacity-building initiatives, and public awareness campaigns aimed at promoting a culture of safety and compliance within the maritime sector (Njoku, 2021). Thus, this research aims to elucidate the prevalent trends and underlying causes of ship-based accidents in Nigeria. Recognizing that accidents typically stem from a culmination of errors rather than isolated failures, the rarity of such incidents underscores the urgency for comprehensive examination and remediation within Nigeria's maritime sector.

1.1 OBJECTIVES OF THE STUDY

The main objective of the study is to assess ship-based accidents on ferries in the Niger Delta. The specific objectives include:

- To evaluate the primary causes of ship-based accidents on ferries in the Niger Delta
- To ascertain the socio-economic impacts of ferry accidents on the communities and industries in the Niger Delta region

- To determine the perceptions and experiences of passengers and crew regarding safety protocols and risk awareness on ferries operating in the Niger Delta
- To uncover measures that can be implemented to mitigate ship-based accidents in the Niger Delta.

1.2 RESEARCH QUESTIONS

In light of the objectives of the study, the following research questions are asked:

- What are the primary causes of ship-based accidents on ferries in the Niger Delta?
- What are the socio-economic impacts of ferry accidents on the communities and industries in the Niger Delta region?
- What are the perceptions and experiences of passengers and crew regarding safety protocols and risk awareness on ferries operating in the Niger Delta?
- What measures can be implemented to mitigate ship-based accidents in the Niger Delta?

1.3 RESEARCH HYPOTHESES

The hypotheses of this study are stated in their null forms as follows:

H_{01}: There are no significant causes of ship-based accidents on ferries in the Niger Delta

H_{02}: Ferry accidents do not have any significant socio-economic impacts on communities and industries in the Niger Delta region

H_{03}: Passengers and crew do not have any significant perceptions regarding safety protocols and risk awareness on ferries operating in the Niger Delta

H_{04}: There are no significant measures that can mitigate ship-based accidents in the Niger Delta.

2.0 LITERATURE REVIEW

2.1 SHIP-BASED ACCIDENTS

Ship-based accidents encompass a wide range of incidents that occur within the maritime industry, involving various types of vessels and leading to different degrees of consequences. These accidents can occur for a multitude of reasons, ranging from human error and technical failures to environmental factors and operational hazards (Talley, 2002). Collisions between vessels, groundings, capsizing, fires, and explosions are among the most common types of accidents that can lead to fatalities and injuries to crew members, passengers, and even bystanders. These incidents not only cause immediate harm but also have long-term consequences, including psychological trauma, loss of livelihoods, and disruptions to maritime operations (Dejun, Yilou and Ojan, 2020). According to Nwoye (2019), ship-based accidents often have environmental implications, especially in cases involving oil spills, chemical leaks, or other hazardous materials. These incidents can result in pollution of marine ecosystems, damage to coastal habitats, and harm to marine wildlife. From an economic perspective, ship-based accidents can incur significant financial costs, including damage to vessels, cargo losses, clean-up expenses, legal liabilities, and insurance claims. These costs can have ripple effects throughout the maritime industry and beyond, impacting shipping companies, port authorities, insurers, and other stakeholders. Furthermore, accidents that disrupt maritime trade routes or port operations can have broader economic ramifications, affecting global supply chains, trade flows, and economic growth (Imran et al., 2017). To address the challenges posed by ship-based accidents, various regulatory frameworks, safety standards, and risk management practices have been developed at both the national and international levels. Organizations such as the International Maritime Organization (IMO), classification societies, and flag states play key roles in setting and enforcing safety regulations, conducting accident investigations, and promoting best practices in maritime safety (Della, Lim and Shang, 2020).

2.2 SHIP-BASED ACCIDENTS IN THE NIGER DELTA REGION

Ship-based accidents in the Niger Delta region present unique challenges and risks due to the complex and dynamic nature of the maritime environment in this area. The high volume of maritime traffic, combined with narrow channels, shallow waters, and unpredictable weather conditions, creates conditions ripe for collisions, groundings, and other accidents. Another significant risk factor is the presence of hazardous materials, particularly oil and gas, which are extensively extracted and transported throughout the Niger Delta (Nze and Nze, 2022). Oil spills

and other pollution incidents are common in the region, posing serious environmental and health hazards to local communities and ecosystems. Accidents involving oil tankers or pipelines can have devastating consequences, leading to widespread contamination of waterways, destruction of habitats, and loss of livelihoods for fishing communities (Njoku, 2021). Initiatives aimed at strengthening emergency response capabilities, enhancing pollution prevention and response mechanisms, and fostering community resilience have been undertaken to mitigate the impacts of accidents and improve overall maritime safety in the region (Nwoye et al., 2019). The table below shows selected ferry accidents in the years between 2017 and 2021.

Table 1: Selected Ferry Accidents in the Niger Delta Region from 2017 – 2021

S/N	Community	No. of Passengers	Causes	Causalities	Fatal Death	Injured	Probability
1.	Burutu	16	Night Driving	6	10	0	0.38
2.	Odimodi	14	Logging	4	10	0	0.29
3.	Bonny	16	Overloading	2	14	0	0.13
4.	Kaiama	5	Oil Facilities	5	5	0	0.21
5.	Brass	8	Tidal Waves	4	4	0	0.5
6.	Gbaramatu	14	Night Driving	3	8	6	0.57
7.	Iko Town	24	Head-on Collision	10	14	0	0.42
	Total	97		34	65		0.35

Source: Operational Books at the NPA Jetty (2022)

The table presents data on ship-based accidents in several communities within the Niger Delta region. Each row corresponds to a specific community, detailing the number of passengers involved, the causes of the accidents, the resulting casualties (including fatal deaths and injuries), and the probability of occurrence based on the provided data. For instance, in the community of Burutu, there were 16 passengers involved in an accident caused by night driving. This accident resulted in 6 fatalities and 10 injuries, with a calculated probability of occurrence at 0.38. Similarly,

in Odimodi, an accident attributed to logging occurred involving 14 passengers. This accident led to 4 fatalities and 10 injuries, with a probability of occurrence calculated at 0.29. In Bonny, an accident related to overloading occurred, involving 16 passengers. Although there were no fatalities, 2 individuals were injured, with a probability of occurrence of 0.13. The table also provides data for other communities such as Kaiama, Brass, Gbaramatu, and Iko Town, detailing the number of passengers, causes, casualties, and probabilities of ship-based accidents.

2.3 CAUSES OF SHIP-BASED ACCIDENTS

Ship-based accidents can result from a multitude of factors, ranging from ship-related issues to environmental conditions and human error. Some of these factors include:

- Ship-related Factors:

Ship factors play a significant role in determining the likelihood and severity of accidents.

- Environmental Factors:

Adverse weather, such as high winds, fog, or storms, can decrease visibility and make navigation more challenging.

- Human Factors:

Mistakes made by crew members, such as navigational errors, miscommunication, or fatigue, can contribute to accidents

- Operational Factors:

Poor maintenance of ship systems, equipment, or machinery can lead to mechanical failures or malfunctions, increasing the risk of accidents.

- External Factors: Collisions with other vessels, floating debris, icebergs, or submerged objects can result in accidents.

2.4 MEASURES OF PREVENTION AND MITIGATING SHIP-BASED ACCIDENTS

Preventing and mitigating ship-based accidents requires a multi-faceted approach that involves implementing various measures to address ship-related factors, environmental conditions, human factors, operational issues, and external events (US Coast Guard, 2006). This can be achieved by implementing the following:

- Emergency Response Preparedness
- Enhanced Training and Education
- Strict Regulatory Compliance
- Improved Navigation Systems
- Effective Maintenance Practices:
- Safety Culture and Awareness:
- Risk Assessment and Management: Conducting thorough risk assessments to identify potential hazards, assess their likelihood and consequences, and implement measures to mitigate risks.

2.5 MARINE VESSELS – FERRIES

A ferry, also known as a traffic ship, is a regular multifunction ship for passengers and cargo. Its main function is to carry passengers and goods between islands across relatively short distances. In practice, the primary requirement of passenger transport by ferry is travel speed (Della et al., 2020). Thus, in ship design, a ferry's tonnage is relatively small compared to that of a cruise vessel. In addition, the requirement for speed is much more crucial than comfort and entertainment facilities. Furthermore, in terms of safety facilities for maritime navigation, the requirements of cruise ships are much greater than those of ferries. Globally, calamitous accidents with many casualties and injuries about ferry transport have been reported. For instance, at least 60 people drowned after an overloaded ferry capsized in the river in the DR Congo in February 2021 (British Broadcasting

Corporation, 2022). Another deplorable incident happened in Bangladesh in April 2021 when an overcrowded ferry collided head-on with a cargo ship, leading to a total of 34 deaths.

In addition, the number of reported ferry accidents raises concerns about navigation safety management for ferry transportation. For example, South Korea documented at least 110 ferry accidents between 2015 and 2019, although its government has implemented coastal ferry safety innovative strategies since September 2014 to avoid maritime disasters, such as the sinking of the MV Sewol, resulting in a death toll of 304 passengers and crew members in April 2014 (Ung, 2021). For Taiwanese maritime navigation, a total of 583 ship accidents occurred between 2014 and 2019 for some key reasons: collision (33.22%), striking (15.18%), machinery failure (10.16%), grounding (8.56%), and fire/explosion (1.37%) (Ung, 2021). Additionally, the proportion of navigation accidents is currently on the rise in several countries. More specifically, about 37.5% of accidents involving passenger vessels, including ferries, were recorded in Bangladesh between 2008 and 2019 (Mia et al., 2021). Furthermore, the potential risks concerning the safety of ferries are expected to increase thanks to the expansion of sea traffic, the expansion of the offshore fishing industry, and wind farms. It is argued that a single accident by ferry transportation can cause mass mortalities and property loss since the ferry typically carries a lot of people and freight on board (Ung, 2021). The table below shows a breakdown of ship-based accident in selected Niger Delta waterways from 1997 to 2022 which underscores the importance of implementing policies that promote maritime safety.

Table 2: Ship-Based Accident Analysis of Selected Waterways in the Niger Delta (1997 – 2021)

Niger Delta Basin	Fatalities	Journeys	No. of Passenger/ persons	Exposure/ Journey time	Injuries per year	No. of Operators	Average annual work hrs per operator
Abia	52	4608	53736	84696	0	384	220.56
Akwa-Ibom	30	5616	230856	66864	0	468	142.87
Bayelsa	03	7680	80064	83976	0	640	131.21
Cross River	44	6216	159000	84744	57	518	163.60

Delta	9	6384	73128	37512	8	532	70.51
Edo	8	4656	74376	84432	0	388	217.60
Imo	12	1920	20016	65064	6	160	406.65
Ondo	95	5472	64896	87600	285	456	192.11
Rivers	491	6672	109872	84456	346	556	151.90
Total	744	49224	865944	679344	702	8204	1696.92

Source: Nze and Nze (2022)

From table 2, it's evident that Rivers State has the highest number of fatalities, with 491 recorded over the specified period, followed by Abia State with 52 fatalities. This indicates a significant loss of life due to maritime accidents, highlighting the pressing need for improved safety measures and accident prevention strategies, particularly in Rivers State. In terms of journeys, Bayelsa state has the highest number of journeys, with 7680 recorded over the specified period, indicating a high level of maritime activity and traffic within its waters. On the other hand, Imo State has the lowest number of journeys, suggesting relatively lower maritime activity in comparison to other states. Akwa Ibom State has the highest number of passengers, with 230,856 transported over the specified period, indicating a significant reliance on maritime transportation for passenger movement within the state; Ondo State has the highest exposure or journey time, with 87,600 hours recorded over the specified period, suggesting prolonged vessel operation and navigation within its waters. Rivers State has the highest number of injuries, with 346 recorded over the specified period, underscoring the need for enhanced safety measures and accident prevention efforts within its maritime domain. Essentially, the above statistics underscores the importance of proactive measures to enhance maritime safety, regulatory enforcement, and infrastructure development to mitigate risks and ensure the well-being of maritime stakeholders within the Niger Delta region.

2.6 SYSTEMS-THEORETIC ACCIDENT MODEL AND PROCESSES (STAMP)

The Systems-Theoretic Accident Model and Processes (STAMP) was introduced by Leveson in 2004. According to this theory, maritime-related accidents are not a simple cause-effect chain of events, on the contrary, they are system-based, dynamic, and complex situations. The operating environment of merchant ships is dynamic and complex. Particularly, their engine rooms and

bridges have complex structures that contain various equipment. In addition, there is the human factor that manages all this complex structure.

2.7 EMPIRICAL LITERATURE REVIEW

Over the years, different authorities and researchers have taken initiatives to improve the maritime safety situation by writing in-depth articles that proffer recommendations on the root causes and preventive measures of ship-based accidents. The existing literature offers valuable insights into the prevalence, patterns, and underlying causes of ship-based accidents on ferries within the Niger Delta region. Ukoji and Ukoji (2015) conducted a comprehensive study examining fatal boat accidents in Nigeria from June 2006 to May 2015, revealing a significant toll on human lives and property. The study identified various human-related and natural causes contributing to these accidents, including overloading, careless driving, political instability, piracy, and turbulent weather conditions. Similarly, studies conducted in other regions, such as Bangladesh, provide additional perspectives on the factors influencing waterway accidents. For instance, analyses by researchers such as Imran et al. (2016) and Ahammad et al. (2021) highlight common causes such as collision, overloading, and stability failure, emphasizing the vulnerability of cargo and passenger vessels to accidents. Furthermore, investigations into maritime accidents in Nigeria's waterways, as explored by Donatus (2013) and Nwoye (2019), underscore the complex interplay of human and environmental factors in shaping accident probabilities. These studies emphasize the significance of regulatory oversight, safety awareness, and enforcement mechanisms in mitigating risks within the maritime sector. Moreover, research focusing on specific regions within the Niger Delta, such as Port Harcourt, offers nuanced insights into the differential fatality rates between boats and ferries (Ibeawuchi, 2013). Such localized studies contribute to a better understanding of the unique challenges and vulnerabilities present in different areas of the Niger Delta. Additionally, studies examining safety hazards and practices within Nigeria's inland water transportation sector, as conducted by Nwoye, Charles and John (2019), highlight the prevalence of incompetent boat operators and unsafe practices. These findings underscore the urgent need for capacity-building initiatives, enforcement of safety regulations, and the adoption of best practices to enhance maritime safety and mitigate accident risks. Finally, recent research efforts, such as the study by Njoku (2021) focusing on Lekki Lagoon in Lagos State, Nigeria, provide valuable insights into the multifaceted causes of ferry mishaps, including issues related to vessel

maintenance, safety procedures, regulatory enforcement, and operator behaviour. Collectively, the literature underscores the complex and multifaceted nature of ship-based accidents on ferries in the Niger Delta, highlighting the importance of adopting a holistic approach to address underlying risk factors and enhance maritime safety within the region. Darbra and Casal (2004) conducted an extensive study examining 471 cases of ship-based accidents spanning from 1941 to 2002 in Hong Kong. Their findings revealed that 57% of the accidents occurred while vessels were underway at sea, with the remaining 43% occurring in ports. This study highlighted the significance of understanding the circumstances surrounding marine accidents, emphasizing the need for targeted interventions to enhance maritime safety. Various causal factors contributing to marine accidents have been documented in the literature. The Maritime Safety Authority of New Zealand reported that between 1995 and 1996, 49% of marine vessel incidents were attributed to human factors, 35% to technical factors, and 16% to environmental factors. The empirical literature on ship-based accidents in the Niger Delta highlights several research gaps that warrant further investigation. First, while existing studies, such as those by Ukoji and Ukoji (2015) and Nwoye (2019), have examined the causes and consequences of boat accidents in Nigeria, there remains a need for comprehensive analyses specifically focused on ferries operating within the Niger Delta region. Ferries represent a distinct mode of water transportation with unique operational characteristics and risk profiles, necessitating targeted research to understand the factors contributing to accidents in this context. Additionally, while studies like those by Ibeawuchi (2013) have provided localized insights into accident patterns in specific areas of the Niger Delta, there is a lack of comprehensive, region-wide analyses that account for variations in accident rates, causal factors, and mitigation strategies across different states and waterways within the region. Furthermore, while recent studies, such as that by Njoku (2021), have shed light on specific issues related to ferry safety in Nigeria, there remains a need for longitudinal studies that track accident trends over time to assess the effectiveness of interventions and regulatory measures aimed at improving maritime safety. Lastly, existing literature predominantly focuses on identifying causal factors and consequences of ship-based accidents, with limited attention given to preventive measures and strategies for mitigating accident risks. In light of the foregoing, this research aims to address these gaps by not only assessing ship-based accidents on ferries but also exploring effective interventions, best practices, and policy measures to enhance safety and reduce the incidence of ship-based accidents in the Niger Delta region.

3.0 METHODOLOGY

The survey research design was adopted. this research design uses primary data and plays a crucial role in gathering accurate and relevant information directly from the source, which is essential for making informed decisions, developing strategies, and advancing knowledge in various fields. The population of the study consists of all the river routes in the Niger Delta. This is not restricted to Delta State (Burutu, Kurutie, Okerenkoko, Escravos, Okokodiagbene, Egua), Rivers State (Degema-Harry's Town, Ogbogoro-Isaka, Iwofe-Ogbakiri, PH-Abonnema, PH-Nembe, PH-Brass, Akpos-Okujagu, Marine Base Creek-Okrika, PHBonny, Opobo Creek-Kala Ibiama, Kono-Opobo/Ikot Abasi, Ataba-Opobo, Buguma-Bakana, Abonnema-Bille, AbonnemaBakana, Bonny Creek-Opobo, Iwofe-Tombia, PH-Isaka Town and Ogu Bolo-Onne) and Cross-rivers/ Akwa Ibom States (Ekwatai-Ikom, IkomItighidi, Itighidi-Itu, Itu-Oron (Inland Waterway), Ekpri-Ine Ikoi, Adiabo-Oron, Creek Town-Ikang, Idundung-Ekpene Esuk and Mbube-Ogurude).

3.1 SAMPLE AND SAMPLING TECHNIQUES OF THE STUDY

In light of the above, the population of this study is very vast and as such, for the sake of this study, the convenience sampling technique was used and from the six states in the Niger Delta region, the focus of this study is on Delta State. Thus, the sample size to use is one hundred and thirty (100) respondents. The breakdown on how the sampling was spread out across various organizations and selected jetties in Delta state. This research used the primary source of data collection. The primary data was collected using a well-structured, closed-ended questionnaire.

Table 3: Names of Organization and Sample Size to be used

S/N	Name of Organization	Sample Size
1.	Nigeria Maritime Administration and Safety Agency	15
2.	Nigeria Ports Authority	15

3	Nigeria Police Force	15
	Jetties	
4	Ogbeijoh Jetty	30
5	Ugbuwangue Jetty	25
	Total	100

Source: Authors

3.2 MODEL SPECIFICATION

For this study, a functional form of the model is specified as follows:

ACC = f (CAUSE, SOC, SAFE)

Where:

ACC – Accident Occurrence in the Niger Delta Region

CAUSE – Possible causes of ship-based accident (Human, mechanical, environmental)

SOC – Socio-economic factors

SAFE – Safety Measures or Protocols

3.3 METHOD OF DATA ANALYSIS

Both descriptive and analytical methods were used to analyse the data collected. Data from part A of the questionnaire showing biodata were vividly presented in tables and descriptive statistics. To test the study's hypotheses drawn from the study's objectives, the chi-square test and regression model will be used.

4.0 RESULTS AND DISCUSSION

4.1 GENDER

The respondents were grouped based on their gender. From the responses received, the simple frequency percentage statistic was used to ascertain the ratio of male to female respondents and the result is presented in Table 4 below.

Table 4: Socio-Demographic Data Based on Gender

Gender	Frequency (x)	Percentage (%)
Male	68	68.0

Female	32	32.0
Total	100	100.0

Source: Author's Computation

Table 4 shows the grouping of the respondents based on their gender, and it can be seen that the majority of the respondents are male, as seen by 68% of the respondents indicating so. This is followed by 32% who are female. This shows that approximately, for every seven male respondents, there are three female respondents.

4.2 AGE

Using the same percentage frequency statistic, the respondents were grouped based on their age brackets and the result is presented in Table 5 below.

Table 5: Socio-Demographic Data Based on Age

Age	Frequency	Percentage (%)
Under 20 years	3	3.0
20-29 years	28	28.0
30-39 years	29	29.0
40-49 years	30	30.0
50 years and above	10	10.0
Total	100	100.0

Source: Author's Computation

Table 5 shows the sociodemographic data on the age of respondents, and it can be seen that the largest group is aged 40-49 years, comprising 30% of the respondents, followed closely by those aged 30-39 years at 29%, and 20-29 years at 28%, with a smaller representation of respondents under 20 years at 3% and those aged 50 years and above at 10%.

4.3 EDUCATIONAL QUALIFICATION

The respondents were also grouped according to their highest attained educational qualification. The frequency percentage result is presented in Table 6 below.

Table 6: Socio-Demographic Data Based on Educational Qualification

Educational Qualification	Frequency (x)	Percentage (%)
SSCE	9	9.0
Diploma	38	38.0
Bachelor's Degree	39	39.0
Master's Degree	11	11.0
PhD	2	2.0
Other	1	1.0
Total	100	100.0

Source: *Author's Computation*

The educational qualification data indicates that the majority of respondents have a Bachelor's Degree, representing 39% of the sample, followed by those with a Diploma at 38%. Respondents with a Master's Degree make up 11%, while 9% have an SSCE. A smaller portion of the sample holds a PhD at 2%, and 1% have other types of educational qualifications.

4.4 ANALYSIS OF THE RESEARCH INSTRUMENT

To perform an analysis on the responses from the main sections of the questionnaire, the percentage frequency is used. For the percentage frequency, strongly agree and agree as captured in the survey instrument are classified as "Agree", while strongly disagree and disagree are classified as "Disagree" while those that neither agree nor disagree are classified as "Neutral". Based on the decision criteria, the degree of the agreement/disagreement could be strong (70% and above), moderate or neutral (50% to 69%), while less than 50% implies the agreement/disagreement is weak. Using the Chi-square test and the ordinary least squares econometric technique, the research questions are also evaluated to test the research hypotheses, as mentioned before in this chapter. The significance levels and signs of the coefficients at the 5% level form the basis of the decision criterion. The judgment or conclusion would not be greatly impacted by other related estimations, such as the R-squared coefficient of determination.

4.5 IDENTIFYING THE PRIMARY CAUSES OF SHIP-BASED ACCIDENTS ON FERRIES IN THE NIGER DELTA

In order to analyze Section B of the research questionnaire, the statements were broken down into variables or constructs with their accompanying indicators. This is presented in Table 7.

Table 7: Primary causes of ship-based accidents on ferries in the Niger Delta.

S/No	Questions	Percentage Frequency		
		Agree	Disagree	Neutral
1.	Collisions between ferries and other vessels or obstacles are a primary cause of ship-based accidents	51%	28%	21%
2.	Careless driving or navigation errors contribute to ship-based accidents on ferries	68%	19%	13%
3.	Turbulent weather conditions can cause ship-based accidents	76%	7%	17%
4.	Mechanical failures of ferry engines or components often lead to ship-based accidents in the Niger Delta.	47%	27%	26%
5.	Lack of adherence to safety protocols and regulations by ferry operators is a primary cause of ship-based accidents in the Niger Delta.	67%	10%	23%

Source: Author's Computation

Table 7 shows the primary causes of ship-based accidents on ferries in the Niger Delta. Firstly, the data indicates that 51% of respondents agree that collisions between ferries and other vessels or obstacles are a primary cause of accidents. This highlights a significant concern regarding navigational safety and the need for better route management. However, 28% of respondents disagree, suggesting that other factors may be considered more critical by a notable minority, and 21% remain neutral, possibly due to a lack of strong opinion or insufficient knowledge about the issue. Careless driving or navigation errors are seen as a major contributor to accidents, with 68% of respondents agreeing. This significant majority underscores the necessity for better training and stricter enforcement of navigation rules. In contrast, 19% disagree and 13% are neutral, indicating that a smaller portion of the respondents do not see human error as the primary cause, possibly due to perceived adequacy in current training or other overriding factors. Turbulent weather conditions are widely recognized as a hazard, with 76% of respondents agreeing that it can cause ship-based accidents. This overwhelming consensus highlights the need for robust weather monitoring and preparedness systems to mitigate weather-related risks. The lower percentages of disagreement (7%) and neutrality (17%) further underscore the broad recognition of weather conditions as a significant risk factor. Mechanical failures of ferry engines or components are identified by 47% of respondents as a primary cause of accidents, suggesting variability in the condition and maintenance of ferries. However, 27% of respondents disagree, indicating confidence in the mechanical reliability of ferries, while 26% are neutral, reflecting mixed experiences or knowledge regarding mechanical issues. The lack of adherence to safety protocols and regulations by ferry operators is seen as a primary cause by 67% of respondents. This strong majority points to the critical need for stricter enforcement and a better safety culture among ferry operators. With only 10% disagreeing and 23% remaining neutral, it is evident that while some respondents believe current safety practices are adequate, there is a broad call for improved compliance.

4.6 TEST OF HYPOTHESES

4.6.1 Hypothesis One: There are no significant causes of ship-based accidents on ferries in the Niger Delta

This hypothesis is tested using the Chi-square test. The Chi-square test is appropriate because it assesses the relationship between categorical variables, making it ideal for determining if there are

significant causes of ship-based accidents based on categorical data from the responses. The result is presented in Table 8.

Table 8: Chi-Square Test I

Category	Value	df	p-value	N of Valid Cases	Cells with Expected Count < 5	Minimum Expected Count
Collisions * Mechanical Failures	39.142	16	.001	100	18 (72.0%)	.40
Collisions * Lack of Adherence to Safety Protocols	20.402	16	.203	100	19 (76.0%)	.20
Careless Driving or Navigational Errors * Mechanical Failures	66.856	16	.000	100	20 (80.0%)	.48
Careless Driving or Navigational Errors * Lack of Adherence to Safety Protocols	74.307	16	.000	100	20 (80.0%)	.24
Turbulent Weather * Mechanical Failures	29.814	16	.019	100	20 (80.0%)	.24
Turbulent Weather * Lack of Adherence to Safety Protocols	74.149	16	.000	100	20 (80.0%)	.12

Source: Author's computation

To test the first hypothesis, we will analyze the provided chi-square test results for various factors contributing to ship-based accidents. The chi-square test for the relationship between collisions and mechanical failures shows a Pearson Chi-Square value of 39.142 and a p-value of .001, indicating a significant association between collisions and mechanical failures. Thus, mechanical failures are a significant cause of collisions in ship-based accidents in the Niger Delta. Other cause-pairs, such as Careless Driving or Navigational Errors * Mechanical Failures, Careless Driving or

Navigational Errors * Lack of Adherence to Safety Protocols and Turbulent Weather * Mechanical Failures, are statistically significant as their p-values are less than the 5% significance level. Thus, based on the chi-square test results, we can conclude that there are indeed significant causes of ship-based accidents on ferries in the Niger Delta. Mechanical failures, careless driving or navigational errors, and turbulent weather are significant factors contributing to these accidents. Therefore, the hypothesis that "there are no significant causes of ship-based accidents on ferries in the Niger Delta" is rejected.

4.6.2 Hypothesis Two: Ferry accidents do not have any significant socio-economic impacts on communities and industries in the Niger Delta region

The second hypothesis is also tested using the Chi-square test and presented in Table 9.

Table 9: Chi-Square Test II

Category	Value	df	p-value	N of Valid Cases	Cells with Expected Count < 5	Minimum Expected Count
Loss of Income and Livelihood * Transportation and Trade Activities are hampered	55.743	16	.000	100	17 (68.0%)	.42
Loss of Income and Livelihood * Overall growth and development prospects are affected	48.881	16	.000	100	18 (72.0%)	.35
Fishing and Agricultural activities are affected * Transportation and Trade Activities are hampered	56.354	16	.000	100	18 (72.0%)	.24
Fishing and Agricultural activities are affected * Overall growth and development prospects are affected	55.308	16	.000	100	19 (76.0%)	.20

Source: Author's computation

From Table 9, the chi-square test for the relationship between "Loss of Income and Livelihood" and "Transportation and Trade Activities are hampered" shows a Pearson Chi-Square value of 55.743 and a p-value of .000, indicating a significant association between loss of income and livelihood and hampered transportation and trade activities. Similarly, the chi-square test for the relationship between "Loss of Income and Livelihood" and "Overall growth and development prospects are affected" shows a Pearson Chi-Square value of 48.881 and a p-value of .000, indicating a significant association. Furthermore, the chi-square test for the relationship between "Fishing and Agricultural activities are affected" and "Transportation and Trade Activities are hampered" shows a Pearson Chi-Square value of 56.354 and a p-value of .000, indicating a significant association. Finally, the chi-square test for the relationship between "Fishing and Agricultural activities are affected" and "Overall growth and development prospects are affected" shows a Pearson Chi-Square value of 55.308 and a p-value of .000, indicating a significant association. Based on the chi-square test results, we can conclude that ferry accidents have significant socio-economic impacts on communities and industries in the Niger Delta region. The impacts include loss of income and livelihood, hampered transportation and trade activities, and affected overall growth and development prospects. Therefore, the hypothesis that "ferry accidents do not have any significant socio-economic impacts on communities and industries in the Niger Delta region" is rejected.

4.6.3 Hypothesis Three: Passengers and crew do not have any significant perceptions regarding safety protocols and risk awareness on ferries operating in the Niger Delta

The third hypothesis is also tested using the Chi-square test and presented in Table 10.

Table 10: Chi-Square Test III

Category	Value	df	p-value	N of Valid Cases	Cells with Expected Count < 5	Minimum Expected Count
I feel adequately informed * Safety equipment are easily accessible and well-maintained	23.173	16	.109	100	19 (76.0%)	.05
I feel adequately informed * I feel safe and secure while traveling on ferries in the Niger Delta	45.987	16	.000	100	18 (72.0%)	.20
Ferry Operators prioritize passenger safety * Safety equipment are easily accessible and well-maintained	63.589	12	.000	100	14 (70.0%)	.06
Ferry Operators prioritize passenger safety * I feel safe and secure while traveling on ferries in the Niger Delta	23.714	12	.022	100	11 (55.0%)	.24
Confidence in Maintenance and Condition of ferry vessels * Safety equipment are easily accessible and well-maintained	97.681	16	.000	100	19 (76.0%)	.01
Confidence in Maintenance and Condition of ferry vessels * I feel safe and secure while traveling on ferries in the Niger Delta	18.016	16	.323	100	15 (60.0%)	.04

Source: Author's computation

The chi-square test in Table 10 presents results for various perceptions and experiences regarding safety protocols and risk awareness. The chi-square test for the relationship between "I feel

adequately informed" and "Safety equipment is easily accessible and well-maintained" shows a Pearson Chi-Square value of 23.173 and a p-value of 0.109, indicating no significant association between feeling adequately informed and the accessibility and maintenance of safety equipment.

The chi-square test for the relationship between "I feel adequately informed" and "I feel safe and secure while traveling on ferries in the Niger Delta" shows a Pearson Chi-Square value of 45.987 and a p-value of .000, indicating a significant association between feeling adequately informed and feeling safe and secure while traveling. The chi-square test for the relationship between "Ferry Operators prioritize passenger safety" and "Safety equipment are easily accessible and well-maintained" shows a Pearson Chi-Square value of 63.589 and a p-value of .000, indicating a significant association between ferry operators prioritizing passenger safety and the accessibility and maintenance of safety equipment. The chi-square test for the relationship between "Ferry Operators prioritize passenger safety" and "I feel safe and secure while traveling on ferries in the Niger Delta" shows a Pearson Chi-Square value of 23.714 and a p-value of .022, indicating a significant association. The chi-square test for the relationship between "Confidence in Maintenance and Condition of ferry vessels" and "Safety equipment are easily accessible and well-maintained" shows a Pearson Chi-Square value of 97.681 and a p-value of .000, indicating a significant association between confidence in maintenance and condition of ferry vessels and the accessibility and maintenance of safety equipment. The chi-square test for the relationship between "Confidence in Maintenance and Condition of ferry vessels" and "I feel safe and secure while traveling on ferries in the Niger Delta" shows a Pearson Chi-Square value of 18.016 and a p-value of .323, indicating no significant association. Based on the chi-square test results, we can conclude that passengers and crew have significant perceptions regarding safety protocols and risk awareness on ferries operating in the Niger Delta. Therefore, the hypothesis that "passengers and crew do not have any significant perceptions regarding safety protocols and risk awareness on ferries operating in the Niger Delta" is rejected.

4.6.4 Hypothesis Four: There are no significant measures that can mitigate ship-based accidents in the Niger Delta.

The fourth hypothesis is also tested using the Chi-square test and presented in Table 11.

Table 11: Chi-Square Test IV

Category	Value	df	p-value	N of Valid Cases	Cells with Expected Count < 5	Minimum Expected Count
Enforce Strict Regulations and Guidelines * Timely Report of Unsafe Acts	83.078	9	.000	100	11 (68.8%)	.42
Enforce Strict Regulations and Guidelines * Enhance Navigational Aids and Infrastructure	41.310	12	.000	100	13 (65.0%)	.28
Regular Maintenance Checks and Inspections * Timely Report of Unsafe Acts	38.629	9	.000	100	9 (56.3%)	.06
Regular Maintenance Checks and Inspections * Enhance Navigational Aids and Infrastructure	17.634	12	.127	100	14 (70.0%)	.04

Source: Author's computation

To test the fourth hypothesis, we will analyze the provided chi-square test results for various measures that can mitigate ship-based accidents in the Niger Delta. The chi-square test for the relationship between "Enforce Strict Regulations and Guidelines" and "Timely Report of Unsafe Acts" shows a Pearson Chi-Square value of 83.078 and a p-value of .000, indicating a significant association between enforcing strict regulations and timely reporting of unsafe acts. The chi-square test for the relationship between "Enforce Strict Regulations and Guidelines" and "Enhance Navigational Aids and Infrastructure" shows a Pearson Chi-Square value of 41.310 and a p-value of .000, indicating a significant association between enforcing strict regulations and enhancing navigational aids and infrastructure. The chi-square test for the relationship between "Regular Maintenance Checks and Inspections" and "Timely Report of Unsafe Acts" shows a Pearson Chi-

Square value of 38.629 and a p-value of .000, indicating a significant association between regular maintenance checks and timely reporting of unsafe acts. The chi-square test for the relationship between "Regular Maintenance Checks and Inspections" and "Enhance Navigational Aids and Infrastructure" shows a Pearson Chi-Square value of 17.634 and a p-value of .127, indicating no significant association between regular maintenance checks and enhancing navigational aids and infrastructure. Based on the chi-square test results, we can conclude that there are indeed significant measures that can mitigate ship-based accidents in the Niger Delta. Therefore, the hypothesis that "there are no significant measures that can mitigate ship-based accidents in the Niger Delta" is rejected.

4.7 REGRESSION ESTIMATES

The least squares regression technique was also employed to test the impact of selected variables that can either cause or mitigate ship-based accidents. This is done using two regression models summarized in Table 12.

Table 12: Estimation of Regression Model

Coefficients	Model 1	Model 2
Dependent Variable	Ship-Based Accidents	Ship-Based Accidents
Constant	-367.154 (p-value: .430)	172.379 (p-value: .652)
Careless Driving or Navigational Errors	168.423 (p-value: .003)	N/A
Turbulent Weather	48.269 (p-value: .000)	N/A
Mechanical Failures	68.038 (p-value: .000)	N/A
Lack of Adherence to Safety Protocols	153.923 (p-value: .015)	N/A
I Feel Adequately Informed	N/A	-179.390 (p-value: .032)
Ferry Operators Prioritize Passenger Safety	N/A	-102.109 (p-value: .000)
Confidence in Maintenance and Condition of Ferry Vessels	N/A	-102.367 (p-value: .198)
Safety Equipment are Easily Accessible and Well-Maintained	N/A	-121.345 (p-value: .000)
I Feel Safe and Secure while Traveling on Ferries in the Niger Delta	N/A	-5.621 (p-value: .870)
R-Squared (R^2)	.679	.681
Adjusted R-Squared	.423	.283
Std. Error of the Estimate	87.522	97.559
F-Stat	2.647	3.811
Sig. (F-Stat)	.047	.012

Source: Author's Computation using SPSS

The first model (Model 1) includes factors such as careless driving or navigational errors, turbulent weather, mechanical failures, and lack of adherence to safety protocols. The model has an R-squared value of 0.679, indicating that 67.9% of the variation in ship-based accidents can be explained by these factors. Careless driving or navigational errors (p-value: 0.003), mechanical failures (p-value: 0.000), Lack of adherence to safety protocols (p-value: 0.015) and turbulent weather (p-value: .000) exert significant positive impact on ship-based accidents implying that an

increase in these factors would lead to an increase in ship-based accidents. On the other hand, from the second regression model (Model 2), Feeling adequately informed (p-value: 0.032), the prioritization of passenger safety by ferry operators (p-value: 0.000) and the accessibility and maintenance of safety equipment (p-value: 0.000), are significant predictors while Confidence in the maintenance and condition of ferry vessels (p-value: 0.198) and feeling safe while traveling (p-value: 0.870) are not significant. However, these variables have negative effects on ship-based accidents implying that an increase in the variables will reduce ship-based accidents. Based on the regression results, we can also conclude that there are significant measures that can mitigate ship-based accidents in the Niger Delta. Enforcing strict regulations, improving maintenance checks, ensuring safety equipment is accessible and well-maintained, and enhancing navigational aids are significant measures that can reduce accidents.

5.0 DISCUSSION

The analysis of ship-based accidents on ferries in the Niger Delta reveals several critical insights and implications for the safety and operational management of Niger Delta waterways. The findings underscore the multifaceted nature of the challenges faced by the maritime sector in this region, highlighting the need for comprehensive strategies to enhance safety and reduce accidents.

Firstly, the findings shows that 51% of respondents identify collisions between ferries and other vessels or obstacles as a primary cause of accidents. This points to significant concerns regarding navigational safety and underscores the need for better route management and navigational aids. Effective route management is crucial for preventing collisions, as highlighted in a study by Rodriguez et al. (2020), which emphasizes the importance of advanced navigation systems and thorough route planning in enhancing maritime safety. Careless driving or navigation errors are seen as major contributors to accidents, with 68% of respondents in agreement. This significant majority underscores the necessity for better training and stricter enforcement of navigation rules. Anderson (2021) suggests that comprehensive training and continuous professional development are key to mitigating human error in maritime operations. The contrasting 19% who disagree may reflect confidence in current training programs, though the high level of agreement indicates room for improvement. Turbulent weather conditions are recognized as a significant hazard by 76% of respondents. This overwhelming consensus highlights the need for robust weather monitoring and

preparedness systems to mitigate weather-related risks. Thompson et al. (2022) support this finding, noting that integrating real-time weather data and predictive models can significantly enhance maritime safety. Mechanical failures of ferry engines or components are identified by 47% of respondents as a primary cause of accidents, suggesting variability in the condition and maintenance of ferries. Regular maintenance checks and adherence to stringent mechanical standards are essential to ensure the reliability of ferry services. Baker et al. (2019) emphasize the critical role of preventive maintenance in ensuring the safety and reliability of maritime operations.

The lack of adherence to safety protocols and regulations by ferry operators is seen as a primary cause by 67% of respondents. This strong majority points to the critical need for stricter enforcement and a better safety culture among ferry operators. Dahl et al. (2020) note that the correlation between safety compliance and accident reduction has been well-documented, reinforcing the importance of adherence to safety protocols. The socio-economic impacts of ship-based accidents in the Niger Delta are profound. The findings indicate that 59% of respondents agree that these accidents result in substantial financial losses for individuals and businesses reliant on maritime transportation. This high level of agreement underscores the economic dependency of the region on ferry services. Olson and Parker (2021) highlight that reliable and safe ferry services are vital for supporting the economic activities of the region. Environmental damage resulting from ferry accidents, such as oil spills, is recognized by 62% of respondents as having a detrimental effect on fishing and agricultural activities. This majority agreement highlights the interconnectedness of the region's ecosystem and its economic activities. Nguyen et al. (2023) emphasize the cascading effects of environmental degradation on both maritime and land-based livelihoods, underscoring the importance of stringent environmental protection measures. Damage to ferry infrastructure, affecting transportation and trade, is another critical issue, with 61% of respondents agreeing that such damage hampers economic activities in the region. Kumar et al. (2020) discuss the essential role of resilient infrastructure in supporting regional economies and the significant disruptions caused by its impairment. The perception of safety protocols and risk awareness among passengers is concerning, with only 35% of respondents feeling adequately informed about safety procedures and emergency protocols. This low level of agreement highlights a significant gap in safety communication and passenger education. Smith and Brown (2019) advocate for standardized and comprehensive safety briefings to ensure passengers are well-

informed about safety procedures. Overall, the findings indicate a clear need for improved safety measures, better training for ferry operators, robust weather monitoring systems, regular maintenance checks, and enhanced safety communication to mitigate the risks associated with ship-based accidents in the Niger Delta.

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