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Original Article

Maritime Safety Regulation and Operational Effectiveness of Shipping Companies in Rivers State, Nigeria

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Abstract: *This study looked into the connection between shipping company efficiency and maritime safety in Nigeria's Rivers State. The study's conceptualization used maritime safety as a predictor of the components of operational performance related to flexibility, responsiveness, and innovation. The study used a correlational style of investigation using a descriptive survey research design. To gather information that was pertinent to the investigation, the questionnaire approach was used. The study population comprised of the twenty (20) functional shipping companies operating with physical offices in Rivers State, which are also enlisted on Finelib.Com Nigerian Directory. The sample size was the same as the population since the population is not too large. However, the researcher adopted a census sampling technique to administer copies of structured questionnaire to four (4) managers in each of the shipping companies. This means that a total of 80 respondents were used for the study. Only 71 copies of the questionnaire were used for the data analysis after the data were cleaned. The Statistical Packages for Social Sciences (SPSS) version 23.0 was used to assess the various hypotheses using the Pearson Product Moment (PPM) correlation. The study's conclusions showed that there is a strong and favourable relationship between maritime safety and the operational efficiency of shipping companies in Rivers State, Nigeria, as determined by their adaptability, responsiveness, and ingenuity to safety regulations and standards in the maritime industry. The study came to the conclusion that there is a strong correlation between maritime safety and the efficiency with which shipping firms operate in Rivers State, Nigeria. The study recommended that managers of shipping companies should adopt maritime safety measures to mitigate challenges within the maritime environment, this will impact on operational effectiveness; managers of shipping companies should implement maritime safety regulations through constant flexibility, responsiveness and innovativeness strategies as this can guarantee their operational effectiveness.*

Keywords: *Maritime-Safety, Operational-Effectiveness, Shipping-Companies.*

I. INTRODUCTION

Over 80% of the world's goods are transported mostly by sea, making the maritime sector an essential part of global trade and business. In Nigeria, a country with a vast coastline and significant maritime resources, the shipping sector plays a pivotal role in facilitating international trade, driving economic growth, and ensuring access to essential commodities (Abubakar, 2019). Maritime safety in Nigeria is a critical concern given the nation's extensive coastline and reliance on maritime transportation for trade and commerce. Ensuring maritime safety involves adherence to international conventions and regulations set by organizations like the International Maritime Organization (IMO). It also requires effective regulatory oversight, proper training of seafarers, implementation of safety protocols, and maintaining well-functioning navigation aids (Ikpechukwu *et al.,* 2020). The integration of technology, including advanced vessel tracking systems, digital platforms for cargo monitoring, and predictive maintenance tools as well as automation and digitalization play a crucial role in streamlining processes, reducing errors, and improving overall efficiency.

For the maritime sector to thrive and contribute effectively to the national economy, two paramount factors must be addressed: maritime safety and operational effectiveness. Maritime safety encompasses a wide range of measures and practices aimed at preventing accidents, protecting human lives, and safeguarding the environment in the maritime domain. It involves adherence to international conventions, rigorous vessel inspection and maintenance, and a strong commitment to best practices in navigation and emergency response (World Economic Forum, 2019). In Nigeria, a country with a history of maritime incidents, ensuring the safety of ships, their crews, and the marine environment is a matter of utmost importance. Operational effectiveness, on the other hand, pertains to the efficiency and competitiveness of shipping companies operating in Nigerian waters. Effective maritime operations involve optimal vessel management, cargo handling, timely delivery, and cost-effective logistics. Achieving operational excellence is not only essential for the profitability of shipping companies but also for the nation's trade competitiveness and overall economic development.

Nigeria has faced challenges in maritime safety, including inadequate emergency response and vessel accidents in terms of collision and fire out breaks. These challenges pose significant threats to both human lives and the marine environment, necessitating comprehensive measures to address the issues effectively. Also, these problems exist probably due to lack of empirical literature to shipping firms and port operators on the relationship between maritime safety regulations and operational effectiveness. Previous studies failed to explain the nexus between maritime safety regulations and operational effectiveness of shipping companies in Rivers State. No known study has emphasized on the relationship between maritime safety and operational effectiveness of shipping companies in Rivers State. By looking at the following, this study aimed to close this knowledge gap and give empirical data on the connection between maritime safety and the operational effectiveness of shipping enterprises in Rivers State.

1. To determine the significant relationship between maritime safety regulation and flexibility of shipping companies in Port Harcourt, Nigeria.
2. To determine the significant relationship between maritime safety regulation and responsiveness of shipping companies in Port Harcourt, Nigeria.
3. To determine the significant relationship between maritime safety regulation and innovativeness of shipping companies in Port Harcourt, Nigeria.

The following hypotheses were postulated to guide the study

Ho_1: There is no significant relationship between maritime safety regulation and flexibility of shipping companies in Port Harcourt, Nigeria.

Ho_2: There is no significant relationship between maritime safety regulation and responsiveness of shipping companies in Port Harcourt, Nigeria.

Ho_3: There is no significant relationship between maritime safety regulation and innovativeness of shipping companies in Port Harcourt, Nigeria.

II. LITERATURE REVIEW

The study examined the triangle theory, a framework for public safety science and technology that is frequently utilised in the fields of emergency management and public safety. The three sides of a triangle can be used to symbolise the emergencies, the affected objects, and the emergency management in the context of public safety science and technology. Disaster components like matter, energy, and information are what bind the three sides together (Very, 2013). The terrible consequences of disaster variables lead to emergencies. It is possible to prevent, stop, and lessen the severity of emergencies and abandonment by carefully examining the genesis, occurrence, development, and mutation evolution of these phenomena. Unexpected occurrences and desertion target the disaster-bearing carrier. Unexpected occurrences and abandonment have an impact on disaster-bearing and hazardous oriented carriers, which can lead to the loss of their functions or ontologies and the emergence of secondary and derivative events (Harel, 2012). A number of human intervention techniques and procedures are used in safety/emergency management with the goal of preventing or lessening emergencies and their effects. It is a crucial component of the "triangular" public safety structure (Nwokedi et al., 2016). The Public Safety Triangle theory provides a useful framework for understanding the complex interactions between various factors that contribute to maritime safety challenges, and can help guide the development of effective strategies to prevent and mitigate the ugly occurrences in the maritime industry. Therefore, it is relevant to study on maritime safety and operational effectiveness of the maritime industry, as it provides a solid theoretical foundation for analyzing and addressing these complex issues.

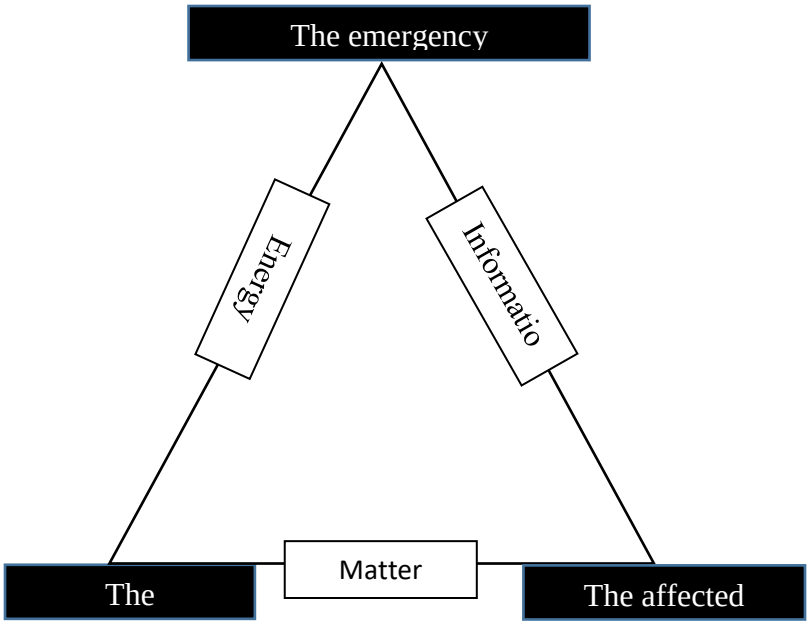

Figure 1: Theory of Triangle

Source: *Research Desk 2023*

Notwithstanding, maritime safety refers to the set of measures, practices, regulations, and protocols established and followed to ensure the safety of human life, property, and the marine environment within the maritime domain. It encompasses a wide range of activities and considerations aimed at preventing accidents, minimizing risks, and responding effectively to emergencies in the maritime industry. The International Maritime Organization (IMO) defines maritime safety as "the measures taken to prevent accidents on or under the water, especially in terms of ships and boats (World Economic Forum, 2019). According to the Safety of Life at Sea (SOLAS) Convention**,** ensuring the safe navigation of vessels through proper charting, navigation aids, and the avoidance of collisions at sea; ensuring that ships are designed, constructed, equipped, and operated in compliance with safety standards to prevent accidents and protect the crew and passengers; implementing safe procedures for loading, stowing, and securing cargo to prevent shifting, damage, or loss during transit; the coordination of efforts to locate, assist, and rescue distressed vessels and individuals at sea; preventing and mitigating pollution of the marine environment, including oil spills and hazardous cargo leaks, to safeguard the ecosystem; protecting vessels, ports, and maritime infrastructure from security threats such as piracy, terrorism, and smuggling, which are also integral to maritime safety; preparedness, training, and the ability to respond promptly and effectively to maritime accidents, including fires, collisions, and grounding; compliance with international and national regulations, codes, and conventions that establish safety standards, procedures, and requirements for maritime operations are aspects of maritime safety.

On the other hand, operational effectiveness refers to the extent to which an organization efficiently utilizes its resources, processes, and capabilities to achieve its strategic goals and objectives. It is a multifaceted concept that encompasses various aspects of an organizational performance and efficiency (Li et al., 2011). Operational effectiveness often involves maximizing resource utilization, minimizing waste, and reducing unnecessary costs. It is about achieving the desired outcomes with the least amount of inputs, including time, labor, materials, and capital. According to El-Tayeb (2017), operational effectiveness is a critical factor in an organization's long-term success and competitiveness. It requires a holistic approach that considers various dimensions of performance and requires continuous monitoring, adaptation, and improvement to meet evolving market demands and challenges.

Flexibility is a key characteristics an industry being adaptable and responsive to changing market conditions, customer demands, and unexpected disruptions as component of operational effectiveness. It involves the ability to adjust processes, resources, and strategies as needed. Flexibility is defined as essentially capacity of adaptation. According to Lloyd et al. (2020), flexibility as “the ability to respond effectively to changing circumstances”. Lloyd infers that flexibility is related to two kinds of change. First, there are “changing circumstances”; and secondly, there is a “response” to these changing circumstances which involves a change in some state or activity. This is applicable to maritime industry when we talk about safety issues in a changing world and technological innovations. In the maritime industry today there are many innovation

introducing more safety consciousness and indecencies which industries must adjust by being flexible to new policies to ensure high level of safety in the maritime industry.

Another important characteristics of an industry in response to challenges is the measure of the extent of its responsiveness. According to Weiwei et al. (2015), responsiveness refers to how quickly businesses respond to changes in their environment in order to take advantage of new opportunities. This responsiveness, which has been viewed as a competitive advantage, represents "the efficiency and effectiveness with which firms sense, interpret, and act on market stimuli" (Nwokedi et al., 2018). A company that is highly responsive surpasses its rivals in terms of operations. The quality or ability to react, adjust, or respond swiftly, efficiently, and sensitively to a specific circumstance, need, request, or stimulus is implied by the term responsiveness. It implies being receptive and adaptive to changes or demands in a way that meets expectations and addresses concerns appropriately.

Innovation is to continuously improving processes, products, or services essential for retaining competitiveness and achieving operational effectiveness. It involves staying ahead of industry trends and finding creative solutions to challenges. Innovativeness reflects a firm's, tendency to engage in and support new ideas, novelty, experimentation and creative processes (Nwokedi et al., 2021) that may result in new products, services, or technological processes and which may take the organization to a new paradigm of success. Lloyd et al. (2020) explained innovativeness as the propensity of a firm to innovate or develop new products that meet and / or exceed customers' expectations or the extent of unmet market needs as reflected in its uniqueness in comparison to similar products offered in the market.

In general, numerous studies have been carried out, such as Nwokedi et al.'s (2018) assessment of organisational safety performance and marine safety management practises in the Nigerian maritime domain: The Case of Bourbon Interoil Nigeria Limited. Therefore, using Bourbon Interoil Nigeria Limited and the International Safety Management Code (ISM code) as case studies, the study was conducted to evaluate the organisational safety performance and marine safety management practises in the Nigerian maritime domain. A comparison of Bourbon's overall performance and the safety performance during the pre- and post-ISM training periods was made. Both historical and survey data were employed in the research, which was conducted using a mix approach, and statistical tools such as trend analysis and the independent sample t-test were used to analyse the data. The trend of accidents and accidents-induced losses was seen to be dramatically lowering after ISM training. The before and post ISM training periods differed significantly, according to the independent sample t-test. Study show much improvement in safety standards and personnel management in terms of efficient safety operations in Bourbon Interoil Nigeria Limited.

III. MATERIALS AND METHOD

This study used a correlational investigation type with a descriptive survey research methodology. The twenty (20) operational shipping companies with physical locations in Port Harcourt, Rivers State, and that are also listed on the Finelib.Com Nigerian Directory made up the population of this study. The sample size was the same as the population since the population is not too large. However, the researcher adopted a census sampling technique to administer copies of structured questionnaire to four (4) managers in each of the shipping companies. This means that a total of 80 respondents were used for the study. Only 71 copies of the questionnaire were used for the data analysis after the data were cleaned. Statistical Packages for Social Sciences (SPSS) version 23.0 was used to evaluate the hypotheses using the Pearson Product Moment (PPM) correlation. The instrument dependability values are shown in Table 1.

Table 1: Results Of Instrument Reliability Test

S/No	Dimension/Measures Of The Study	Number Of Item	Cronbach's Alpha
1	Maritime Safety	5	0.842
2	Flexibility	5	0.775
3	Responsiveness	5	0.849
4	Innovativeness	5	0.703

Source: *Research data output, 2023.*

The four constructs utilised for the investigation showed high reliability ratings of 0.842, 0.775, 0.849, and 0.703 correspondingly, according to the instrument reliability data provided in Table 1. In light of the foregoing, it follows that the research tools used for the study have adequate constructs dependability.

IV. DATA ANALYSIS

Table 2: Descriptive Statistics of Maritime Safety

	N	Sum	Mean	Std. Deviation	Variance
We have an operational system and alarm arrangements for ships with water level detectors.	71	292	4.11	.728	.530
We have public address systems that are capable of broadcasting emergency information.	71	296	4.17	.862	.742
We have a muster list that specifies details in line with the requirements of SOLAS 1996-1998 amendment	71	315	4.44	.841	.707
We have an authentic source of power supply for emergencies	71	306	4.31	.709	.503
We adopt modern technologies to run our warehouse	71	272	3.83	1.331	1.771
Valid N (listwise)	71				

Source: *SPSS OUTPUT, 2023.*

Table 2 shows high mean questionnaire scores of above 3.00, indicating that more respondents agreed and strongly agreed with the research question on maritime safety. The highest mean score, 4.44, was given to issue 3, which assessed the extent to which Port Harcourt maritime firms had muster lists that specified specifics in accordance with the standards of SOLAS 1996-1998 amendment. This demonstrates that the third question has the greatest impact on the variables.

Table 3: Descriptive Statistics of Flexibility

	N	Sum	Mean	Std. Deviation	Variance
We know the requirements for survival in this highly competitive environment	71	321	4.52	.772	.596
Our job allows our staff to leave an hour earlier if they can cover itup on another working day in that week.	71	300	4.23	.831	.691
We have developed capacity for new technologies	71	298	4.20	1.064	1.132
We have adjusted to new working conditions to manage the competition	71	291	4.10	.796	.633
Our productivity at work is greater due to flexible working hours.	71	305	4.30	.852	.726
Valid N (listwise)	71				

Source: *SPSS OUTPUT, 2023.*

Table 3 shows high mean questionnaire scores of above 3.00, indicating that more respondents agreed and strongly agreed with the research question about flexibility. However, it is clear that question 1, which assessed how well Port Harcourt shipping firms understood the conditions necessary to thrive in this intensely competitive climate, had the highest mean score of 4.52. This demonstrates that variable 1 has the biggest impact on the others.

Table 4: Descriptive Statistics of Responsiveness

	N	Sum	Mean	Std. Deviation	Variance
Our services are accurate.	71	279	3.93	1.280	1.638
We deliver our transport service at the right time of schedule.	71	257	3.62	1.163	1.353
Wekeep accurate records of bookings and schedules.	71	310	4.37	1.059	1.121
We give attention to customer complaint	71	321	4.52	.772	.596
We treat customer complaints within shortest possible time.	71	308	4.34	.877	.770
Valid N (listwise)	71				

Source: *SPSS OUTPUT, 2023.*

A higher percentage of respondents agreed and strongly agreed with the research issue about responsiveness, as shown in Table 4 high mean scores of the questionnaire questions ranging over 3.00. But as can be seen, question 4, which examined how much attention Port Harcourt shipping businesses pay to client complaints, received the highest mean score of 4.52. This demonstrates that the fourth question has the greatest impact on the variables.

Table 5: Descriptive Statistics of Innovativeness

	N	Sum	Mean	Std. Deviation	Variance
We use superior technology to achieve efficiency	71	318	4.48	.876	.767
Our services are unique in the market and not easily imitated	71	270	3.80	1.090	1.189
We seek to continuously improve our services to meet our company's varied needs	71	350	4.93	.308	.095

Our services are user friendly	71	239	3.37	.797	.635
We review our processes from time to time to ensure survival	71	261	3.68	1.193	1.422
Valid N (listwise)	71				

Source: *SPSS OUTPUT, 2023.*

Table 5 shows high mean questionnaire score averages over 3.00, indicating that more respondents agreed and strongly agreed with the research question about innovativeness. However, it is clear that question 3, which examined how much Port Harcourt shipping firms strive to continuously enhance their offerings in order to satisfy a variety of client demands, had the highest mean score, coming in at 4.93. This demonstrates that the third question has the greatest impact on the variables.

Test of Hypotheses One: There is no significant relationship between maritime safety and flexibility of shipping companies in Port Harcourt, Nigeria.

Table 6: Analysis of the Relationship between Maritime Safety and Flexibility

		Maritime Safety	**Flexibility**
Maritime Safety	Pearson Correlation	1	.772**
	Sig. (2-tailed)		.000
	N	71	71
Flexibility	Pearson Correlation	.772**	1
	Sig. (2-tailed)	.000	
	N	71	71
**. Correlation is significant at the 0.01 level (2-tailed).			

Source: *SPSS Output*

According to the SPSS result on Table 6, there is a strong significant and positive association between maritime safety and flexibility, with a correlation coefficient of 0.772**. Further demonstrating that there is a highly significant association between maritime safety and flexibility is the fact that the probability value (0.000) is smaller than the crucial value (0.05). This suggests even more that flexibility among Port Harcourt's shipping businesses can be achieved through the use of maritime safety. As a result, we reject the null hypothesis, according to which there is no relationship between maritime safety and the adaptability of shipping companies in Port Harcourt, Nigeria, and accept the alternative hypothesis, according to which there is a strong relationship between the two.

Test of Hypotheses Two: There is no significant relationship between maritime safety and responsiveness of shipping companies in Port Harcourt, Nigeria.

Table 7: Analysis of the Relationship between Maritime Safety and Responsiveness

		Maritime Safety	**Responsiveness**
Maritime Safety	Pearson Correlation	1	.536**
	Sig. (2-tailed)		.000
	N	71	71
Responsiveness	Pearson Correlation	.536**	1
	Sig. (2-tailed)	.000	
	N	71	71
**. Correlation is significant at the 0.01 level (2-tailed).			

Source: *SPSS Output*

According to Table 7's SPSS output, there is a moderately significant and positive link between maritime safety and responsiveness, with a correlation coefficient of 0.536**. Further evidence that there is a moderately significant association between maritime safety and responsiveness can be seen in the fact that the probability value (0.000) is less than the crucial threshold (0.05). This also suggests that Port Harcourt's shipping businesses might be made more responsive through the use of maritime safety. As a result, we reject the null hypothesis, according to which there is no relationship between maritime safety and the responsiveness of shipping companies in Port Harcourt, Nigeria, and accept the alternative hypothesis, according to which there is a moderately significant relationship between the two variables.

Test of Hypotheses Three: There is no significant relationship between maritime safety and innovativeness of shipping companies in Port Harcourt, Nigeria.

Table 8: Analysis of the Relationship between Maritime Safety and Innovativeness

		Maritime Safety	Innovativeness
Maritime Safety	Pearson Correlation	1	.814**
	Sig. (2-tailed)		.000
	N	71	71
Innovativeness	Pearson Correlation	.814**	1
	Sig. (2-tailed)	.000	
	N	71	71
**. Correlation is significant at the 0.01 level (2-tailed).			

Source: *SPSS Output*

The correlation coefficient between marine safety and innovativeness, as shown by the SPSS output on Table 8, is 0.814**, demonstrating a very strong significant and positive association between the two. Further evidence that there is a very strong significant association between maritime safety and innovativeness comes from the fact that the probability value (0.000) is less than the crucial value (0.05). This suggests even more that Port Harcourt's shipping industry may leverage marine safety to spur innovation. As a result, we reject the null hypothesis, according to which there is no relationship between maritime safety and the inventiveness of shipping companies in Port Harcourt, Nigeria, and accept the alternative hypothesis, according to which there is a very strong relationship between the two.

V. DISCUSSION OF FINDINGS

According to the study's findings, there is a high positive association between operational flexibility and marine safety, with a correlation coefficient of 0.772 between the two. Furthermore, the probability value of (0.000) is smaller than the crucial threshold (0.05), indicating that there is a strong correlation between operational flexibility and marine safety in the maritime business. The study also demonstrates a good association between marine safety and operational responsiveness, with a correlation coefficient of 0.536 between the two variables. Because the probability value of (0.000) is smaller than the crucial value of (0.05), it may be inferred that there is a strong correlation between operational responsiveness of the maritime sector to changes in safety regulations and difficulties and maritime safety. The relationship between marine safety and innovativeness is favourable, as indicated by the correlation coefficient of 0.814 between the two variables. Further evidence that there is a very significant association between maritime safety and operational innovation in the maritime industry in Rivers State comes from the probability value of (0.000) being smaller than the critical value (0.05).

In conclusion, the results of this study informs that maritime safety regulations significantly relates with operational effectiveness of shipping companies in Rivers State Nigeria, through their unique characteristics in terms of flexibility, responsiveness and innovativeness to curb safety challenges posed by new technologies in the changing world in the maritime industry. Thus, maritime safety regulations help shipping companies to adhere to safety standards for operational efficiency in the maritime industry which promotes the image of the industry and its competitiveness in the global market.

Based on the findings of the study, it is recommended that:

1. Managers of shipping companies should adopt maritime safety measures that adhere to new technological advancement in the maritime industry to enhance operational effectiveness.
2. Managers of shipping companies should implement maritime safety regulations as this can guarantee their operational effectiveness.
3. Shipping companies should imbibe the attributes - flexibility, responsiveness and innovativeness as organizational strategy for improving safety standards and efficiency in operational performance in the modern world of frequent technological advancement.

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