PRINT ISSN 1119-8362
Electronic ISSN 2659-1499

Full-text Available Online at
https://www.ajol.info/index.php/jasem
https://www.bioline.org.br/ja

J. Appl. Sci. Environ. Manage.
Vol. 28 (12) 3945-3952, Dec. 2024

Perceived Effects of Port and Harbor Accidents on Its Operational Performance: A Case Study of Apapa Seaport, Lagos State, Nigeria

***ANYANWU, OJ; OMOKE, V; NWACHUKWU, CT; OKOREFE, OC**

Department of Transport & Nautical Science, Faculty of Transport, Nigeria Maritime University, Okerenkoko. Warri South LGA, Delta State, Nigeria

**Corresponding Author Email: okey_good2002@yahoo.com*
**ORCID ID: https://orcid.org/0000-0002-3621-1470*
***Tel:** +2348036608592*

Co-Authors Email: Omoke.victor@futminna.edu.ng; tochin@nda.edu.ng; twindeck638@yahoo.com

ABSTRACT: The objective of this study was to evaluate the perceived effects of port and harbor accidents on its operational performance at the Apapa Seaport, Lagos State, Nigeria using eighty (80) questionnaires which were appropriately distributed out of which seventy-five (75) were accurately filled and returned. The study revealed that the majority of these accidents were caused by human error, equipment failure, and poor maintenance. The high rate of accidents at the Nigeria seaports has a significant effect on its operational performance and the study therefore recommends that near miss cases of accidents which contributes to more than 50% of total accidents in the port should be avoided including other recommendations.

DOI: https://dx.doi.org/10.4314/jasem.v28i12.1

Cite this Article as: ANYANWU, O. J; OMOKE, V; NWACHUKWU, C. T; OKOREFE, O. C. (2024). Perceived Effects of Port and Harbor Accidents on Its Operational Performance: A Case Study of Apapa Seaport, Lagos State, Nigeria. *J. Appl. Sci. Environ. Manage.* 28 (12) 3945-3952

Dates: Received: 22 October 2024; Revised: 20 November 2024; Accepted: 08 December 2024; Published: 18 December 2024

Keywords: Seaport; Harbor; Accidents; Operational; Performance

A Seaport is a zone on a coast or shore containing minimum of one harbor where ship/vessel can dock and move people or cargo to or from the land, Wikipedia (2022). An accident is an unintended, normally unwanted event that was not directly caused by humans. The term accident implies that nobody should be blamed, but the event may have been caused by unrecognized or unaddressed risk (Wikipedia 2022) stated that an accident is an unforeseen circumstance that is sometimes beyond inevitable but can be avoided. Some of the accidents that occurs in the port and harbor are: crane and winch accidents; Conveyor belt accidents; Fires and explosions; Slips and falls on slippery surfaces including ship's deck and surfaces, (Maritime Injury Guide 2022) and Zhang *et al*., (2017). Also, several scientific materials have also been implemented in decision-making to develop theories, methodologies, and equipment required to assess accidents and risks, (Chlomoudis *et al*, 2011). Moreover, there is a need to apply these efforts in handling safety at the port, especially at the dock, (Hamka, 2007) to reduce or eliminate the effects of certain environmental, weather, human, social, and economic factors (Lee *et al.*, 2020) such as compensation for damage or death, prevention of pollution, and other medical expenses (Dayananda and Dwarakish (2018). The port provides information, costs, Manca *et al.*, (2019), and facilities required by consumers to use container loading and unloading services and also considers the accident rate and material damage (Dutra *et al.*, 2015). Accidents are caused by persons,

**Corresponding Author Email: okey_good2002@yahoo.com*
**ORCID ID: https://orcid.org/0000-0002-3621-1470*
***Tel:** +2348036608592*

environments, managements and equipment (NPA, 2022). On the other hand, Port performance has to do with how efficiently and effectively a port functions, Awal and Hasegawa (2016). In order for a port to work efficiently, accidents should be avoided because it can be a major factor of treat to vessels calling at the port. The need for growth in the maritime industry or productivity of a port has resulted in the rise in the throughput of cargo, leaving the port operators to the task of meeting up in the clearing of cargo within the shortest period of time, (Adegbite *et al.,* (2020). The targets of the Port concession or reform was to build proficiency in port operation, lessening expense of port administrations to stakeholders, reduction of cost to the government for the backing of port sector and pull in private sector in order to free public assets for public services according to Kim *et al.,* (2018). This study is carried out to bring to light the perceived effect of port and harbor accidents in port operational performance. Port operators are constantly faced with serious problems at the port while handling cargoes (containerized and non-containerized cargoes) too many injuries occur in ports and terminals. These accidents can be very serious and may result in loss of lives, damage to cargo or vessel etc. Many at times these accidents occur as a result of negligence, operation of cargo handling equipment by unskilled staff, and lack of adequate maintenance of this equipment. According to Darbra Casal's study (2004), the majority of accidents represented by 56.5% on the ports were due to cargo transportation, 14.9% by loading and unloading operations, and 15.9% because of human error. The potential ability of accidents to occur in ports and harbor is so high so therefore there is need for effective and efficient management of risk and handling safety in port. The objective of this paper is to evaluate the perceived effects of port and harbor accidents on its operational performance at the Apapa Seaport, Lagos State, Nigeria

MATERIALS AND METHODS

Research design adopted in this research is survey research design. The Taro Yamene sample size determination formula for finite population was used to select a sample of 80 (eighty) from the population which consist of one hundred (100) employees and operators at the port and harbor area, while a descriptive statistic was used to analyse the data.

RESULTS AND DISCUSSIONS

Response Rate: Descriptive statistics such as frequencies and percentages have been used to analyze responses to a variety of objects in the questionnaire. The research survey resulted in a response rate of 94% in the place by way of 75 out of the 80 respondents in the goal populace replied to the questionnaires administered to them. The result from table .2 shows the result of gender respondents 70.7% are male while 29.3% are female, which shows that there was gender no biasness.

Table: 1. Respondent Rate

Response Rate	Frequency	Percent
Responded	75	94%
Not Responded	5	6%
Total	**80**	**100**

***S**ource: Research survey 2024.*

Table .2. Gender of Respondents

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male	53	70.7	70.7	70.7
Female	22	29.3	29.3	100.0
Total	**75**	**100.0**	**100.0**	

Source: Research Survey, 2024.

The results obtained from table 3 shows that 6.7% of the respondents are between the ages of 17-25, 37.3% of the respondents are between ages of 26-35, while ages between 36-45 ages are 40.0% which happens to be the highest and 16.0% are between the ages of 46 - above. The results obtained from table 5 shows that 10.7% are Primary school holders, 44.0% are Secondary school which has the highest percentage, Tertiary has 30.7% and while 14.7% are none. The results obtained from table 6 shows that 45.3% are married which have the highest percentage 40.0% are single and while 14.7% are widower. The results obtained from table 7 shows that 22.7% are stevedore workers, 52.0% are terminal operators which happens to have the highest frequency of department in Apapa port in this survey, 16.0% are longshoremen, clerical are 8.0% while 1.3% are under others. Thus, clients were included in this table in other for proper accountability of results to avoid miss items in this category. The results obtained from table.8 shows that 1.3% are 0 – 12 months, 1.3% are 1 – 2yrs, 21.3% are 3 – 5yrs, 56.0% are 5 – 7yrs which happens to have the highest working experience in Apapa port in this survey, 20.0% are 7yrs and above. In Table 9, the rate of port accident was evaluated by asking a question as Have you witnessed any port/harbour accident in the port? responds obtained show that out of 100 (100%) respondents 30.7% are neutral, 53.3% agreed, 10.7% strongly agreed that they have witnessed port/harbour accident in the port. When asked if Collision accident occur more at port/harbour? It was observed that out of 100 (100%) respondents, 5.3% strongly disagree, 1.3% disagreed, 21.3% are neutral, 58.7% agreed while 13.3% strongly agreed to that collision accident occur more

at port/harbor. When the question Slip/fall accidents occur more at port/harbour? Arouse, observation shows that that out of 100 (100%) respondents, 20.0% disagree, 21.3% are neutral, 48.0% agreed, while 10.7% strongly agreed to slip/fall accidents occur more at port/harbor.

Table. 3. Age of Respondents

Age	Frequency	Percentage	Valid Percentage	Cumulative Percentage
17-25	5	6.7	6.7	6.7
26-35	28	37.3	37.3	44.0
36-45	30	40.0	40.0	84.0
46 above	12	16.0	16.0	100.0
Total	**75**	**100.0**	**100.0**	

Source: Research Survey, 2024.

Table: 5. Educational qualification respondents

Qualification	Frequency	Percent	Valid Percent	Cumulative Percent
Primary	8	10.7	10.7	10.7
Secondary	33	44.0	44.0	54.7
Tertiary	23	30.7	30.7	85.3
None	11	14.7	14.7	100.0
Total	**75**	**100.0**	**100.0**	

Source: Research Survey, 2024.

Table: 6. Marital *Status*

Status	Frequency	Percent	Valid Percent	Cumulative Percent
Married	34	45.3	45.3	45.3
Single	30	40.0	40.0	85.3
Widower	5	6.7	6.7	100.0
Total	**75**	**100.0**	**100.0**	

Source: Research Survey, 2024

Table: 7. *Occupation*

Departments	Frequency	Percent	Valid Percent	Cumulative Percent
Stevedore	17	22.7	22.7	22.7
Terminal operators	39	52.0	52.0	74.7
longshoremen	12	16.0	16.0	90.0
Clerical	6	8.0	8.0	98.7
Others	1	1.3	1.3	100.0
Total	**75**	**100.0**	**100.0**	

Source: Research Survey, 2024.

Table 8 Experience

	Working experience				
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0- 12 months	1	1.3	1.3	1.3
	1-2yrs	1	1.3	1.3	2.7
	3-5yrs	16	21.3	21.3	24.0
	5-7yrs	42	56.0	56.0	80.0
	above 7yrs	15	20.0	20.0	100.0
	Total	75	100.0	100.0	

Source: Research Survey, 2024.

When asked if Grounding accident occur at port/harbour? It was observed that out of 100 (100%) respondents, 2.7% strongly disagree, 6.7% disagreed, and 20.0% are neutral, 49.3% agreed while 21.3% strongly agreed that grounding accident occur at port/harbor. When they were asked about equipment failure accident occurring at port/harbor, out of 100 (100%) respondents, 5.3% strongly disagree, 18.7% disagreed, and 33.3% are neutral, 33.3% agreed while 9.3% strongly agreed that equipment failure accident occur at port/harbor. On the question of if fire outbreak/explosion accident occur more at port/harbor, out of 100 (100%) respondents, 1.3% strongly disagree, 5.3% disagreed, 36.0% are neutral, 40.0% agreed while 17.3% strongly agreed that fire outbreak/explosion accident occur more at port/harbor. The last question, port/harbor accident occur very frequently at the port/harbor, out of 100 (100%) respondents, 4.0% disagree, 38.7% are neutral, 50.7% agreed, while 6.7% strongly agreed that port/harbor accident occur very frequently at the port/harbor. In Table 10, the effects of port/ harbour accident were evaluated by asking a question as It cost extra expenses on the management to do repairs after accidents? Response to the question show that out of 100 (100%) respondents, 1.3% disagreed,

24.0% are neutral, 50.7% agreed, 24.0% strongly agreed that it cost extra expenses on the management to do repairs after accidents. When asked about the damage of port/harbour facilities, the response indicates that out of 100 (100%) respondents, 2.7% strongly disagree, 10.7% disagree, 34.7% are neutral, 38.7% agreed, 13.3% strongly agreed. On the effects of port/ harbour accident on loss of lives, the response indicated that 2.7% strongly disagree, 10.7% disagree, 34.7% are neutral, 38.7% agreed, 13.3% strongly agreed while on effect of damage to cargo handled at the port, the response showed that out of 100 (100%) respondents 37.3% are neutral, 50.7% agreed, 12.0% strongly agreed that port accident affects damage of cargo handled at port/harbor.

Table 9. The rate of port accident in study area

S/N	OPTIONS	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total
1	Have you witnessed any port/harbour accident in the port?	0	4 5.3%	23 30.7%	40 53.3%	8 10.7%	100
2	Collision accident occur more at port/harbour?	4 5.3%	1 1.3%	16 21.3%	44 58%	10 13.3%	100
3	Slip/fall accidents occur more at port/harbour?	0	15 20.0%	16 21.3%	36 48.0%	8 10.7 %	100
4	Grounding accident occur at port/harbour?	2 2.7%	5 6.7%	15 20.0%	37 49.3%	16 21.3%	100
5	Equipment failure accident occur at port/harbour?	4 5.3%	14 18.7%	25 33.3%	25 33.3%	7 9.3%	100
6	Fire outbreak/ explosion accident occur more at port/ harbour?	1 1.3%	4 5.3%	27 36.0%	30 40.0%	13 17.3%	100
7	Do you agree that port/harbour accident occur very frequently at the port/harbour?	0	3 4.0%	29 38.7%	38 50.7%	5 6.7%	100

Source: Field survey, 2024.

Table 10: Effects of port/ harbour accident.

S/N	Options	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total
1	It cost extra expenses on the management to do repairs after accidents	0	1 1.3%	18 24.0%	38 50.7%	18 24.0%	100
2	Damage of port/harbour facilities	0	0	12 16.0%	38 50.7%	25 33.3%	100
3	Loss of lives	2 2.7%	8 10.7%	26 34.7%	29 38.7%	10 13.3%	100
4	Damage of harbour facilities	0	0	28 37.3%	38 50.7%	9 12.0%	100

Source: Field survey, 2024.

Table 11. **Safety practices to mitigate port/harbour accident in study area.**

S/N	**OPTIONS**	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**	**Total**
1	Safety rules are in effect and enforced during port/harbour activities	5 6.7%	12 16.0%	30 40.0%	28 37.3%	0	100
2	The implementation of planned maintenance system (PMS)a safe practice to prevent accident occurrence	0	14 18.7%	30 40.0%	31 41.3%	0	100
3	Regular maintenance of machinery equipment	0	9 12.0%	26 34.7%	31 41.3%	9 12.0%	100
4	Is there an action safety reporting culture	2 2.7%	7 9.3%	31 41.3%	32 42.7%	3 4.0%	100
5	Is there an action safety culture?	2 2.7%	9 12.0%	34 45.3%	25 33.3%	5 6.7%	100
6	Is risk management preparation done?	2 2.7%	6 8.0%	30 40.0%	24 32.0%	13 17.3%	100
7	Are safety training carried out frequently?	0	1 1.3%	25 33.3%	38 50.7%	11 14.7%	100

Source: Field survey, 2024.

In Table 11, Safety practices to mitigate port/harbour accident in study area was evaluated by asking a question as are Safety rules are in effect and enforced during port/harbour activities? responds obtained

show that out of 100 (100%) respondents, 6.7% strongly disagree, 16.0% disagreed, 40.0% are neutral, 37.3% agreed that safety rules are in effect and enforced during port/harbor activities, when asked about the implementation of planned maintenance system (PMS)a safe practice to prevent accident occurrence? out of 100 (100%) respondents, 18.7% disagree, 40.0% are neutral, 41.3% agreed to the implementation of planned maintenance system (PMS) a safe practice to prevent accident occurrence, the respondents were asked about Regular maintenance of machinery equipment to mitigate accident in the study area, out of 100 (100%) respondents, 12.0% disagree, 34.7% are neutral, 41.3% agreed, while 12.0% strongly agreed to the regular maintenance of machinery equipment. Also Is there an action safety reporting culture? out of 100 (100%) respondents, 2.7% strongly disagree, 9.3% disagreed, and 41.3% are neutral, 42.7% agreed, while 4.0% strongly agreed that there is a need for action safety reporting culture. The respondents were also asked Is risk management preparation done? out of 100 (100%) respondents, 2.7% strongly disagree, 12.0% disagreed, and 45.3% are neutral, 33.3% agreed, while 6.7% strongly agreed that there is an action safety culture. On the question of if risk management are done? out of 100 (100%) respondents, 2.7% strongly disagree, 8.0% disagreed, and 40.0% are neutral, 32.0% agreed, while 17.3% strongly agreed that risk management preparation is done. Also are safety training carried out frequently? In this response, out of 100 (100%) respondents, 1.3% disagree, 33.3% are neutral, 50.7% agreed, while 14.7% strongly agreed that safety training carried out frequently.

Table 12 **major causes of port/harbour accident.**

S/N	Options	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total
1	Level of training & experience contribute to the occurrence of port/harbour accident	0	1 1.3%	23 30.7%	41 54.7%	10 13.3%	100
2	Fatigue has played a role in the occurrence of port/ harbour accident	0	3 4.0%	35 46.7%	36 48.0%	1 1.3%	100
3	Unconscious behaviour plays a role in the occurrence of port/harbour accident	0	0	20 26.7%	43 57.3%	12 16.0%	100
4	Ignorance/negligence/lack of attention plays a vital role in the occurrence of port/harbour accident	0	2 2.7%	31 41.3%	42 56.0%	0	100
5	Communication contributes to the occurrence of port/harbour accident.	0		24 32.0%	46 61.3%	5 6.7%	100
6	Stress and health of port workers contribute to the occurrence of port/harbour accident.	0	2 2.7%	26 34.7%	31 41.3%	16 21.3%	100
7	Human factor is a core cause of port/harbour accident	0	0	29 38.7%	42 56.0%	4 5.3%	100
8	Machinery/equipment failure is a major component of port/harbour accident	0	0	23 30.7%	49 65.3%	3 4.0%	100
9	Lack of periodic maintenance is a core component of port/harbour accident	0	1 1.3%	32 42.7%	42 56.0%	0	100
10	Over capacity usage is a major cause of port/harbour accident.	0	1 1.3%	35 46.7%	35 46.7%	4 5.3%	100
11	Fault in design/ construction of machinery/equipment has played a role in port/harbour accident.	0	1 1.3%	23 30.7%	46 61.3%	5 6.7%	100
12	Management carries out safety meetings at regular intervals	0	11 14.7%	39 52.0%	24 32.0%	1 1.3%	100
13	Accident/near accident reports are recorded by management	0	15 20.0%	39 52.0%	21 28.0%		100
14	Accident/near accident report are raised and handled in a satisfactory manner by the management	2 2%.7	13 17.3%	27 36.0%	20 26.7%	13 17.3%	100
15	Irregular storage area provided by management is a major cause of port/harbour accident	8 10.7	12 16.0%	25 33.3%	28 37.3%	2 2.7%	100
16	Failure to consider dangerous goods separation by management is a major cause of port/harbour accident	2 2.7%	11 14.7%	25 33.3%	26 34.7%	11 14.7	100
17	Coordination deficiency by management is a core cause of port/harbour accident	0	10 13.3%	41 54.7%	20 26.7%	4 5.3%	
18	Do you agree that organisational/management factor is a core cause of port/harbour accident	1 1.3%	8 10.7%	28 37.3%	28 37.3%	10 13.3%	100
19	Unfavourable weather condition played a vital role in the occurrence of port/harbour accident	2 2.7%	4 5.3%	18 24.0%	46 61.3%	5 6.7%	100
20	Do you agree that environmental factor is a core cause of port/harbour accident	4 5.3%	13 17.3%	36 48.0%	22 29.3%		100

Source: Field survey, 2024

In Table 12, evaluated the 12 major causes of port/harbour accident in study area by asking a question as Level of training & experience contribute to the occurrence of port/harbour accident? responds obtained show that out of 100 (100%) respondents, 1.3% disagreed, 30.7% are neutral, 54.7% agreed, while 13.3% strongly agreed that the level of training and experience contribute to the occurrence of port/harbor accident. When asked Fatigue has played a role in the occurrence of port/ harbour accident? out of 100 (100%) respondents, 4.0% disagree, 46.7% are neutral, 48.0% agreed, while 1.3% strongly agreed that fatigue has played a role in the occurrence of port/harbor accident. On the question of Unconscious behaviour plays a role in the occurrence of port/harbour accident. out of 100 (100%) respondents, 26.7% are neutral, 57.3% agreed, while 16.0% strongly agreed that unconscious behavior plays a role in the occurrence of port/harbor accident. When asked if Ignorance/negligence/lack of attention plays a vital role in the occurrence of port/harbour accident, out of 100 (100%) respondents, 2.7% disagree, 41.3% are neutral, 56.0% agreed to ignorance/negligence/lack of attention plays a vital role in the occurrence of port/harbor accident. On the issue of Communication contributes to the occurrence of port/harbour accident? out of 100 (100%) respondents, 32.0% are neutral, 61.3% agreed, while strongly agreed to communication contribute to the occurrence of port/harbor accident. When respondents were asked Stress and health of port workers contribute to the occurrence of port/harbour accident? out of 100 (100%) respondents, 2.7% disagree, 34.7% are neutral, 41.3% agreed that stress and health of port workers contribute to the occurrence of port/harbor accident. On if Human factor is a core cause of port/harbour accident? out of 100 (100%) respondents, 38.7% are neutral, 56.0% agreed, 5.3% strongly agreed that human factor is a core cause of port/harbor accident. The were also asked if Machinery/equipment failure is a major component of port/harbour accident? out of 100(100%) respondents, 30.7% are neutral, 65.3% agreed, 4.0% strongly agreed that machinery/equipment failure is a major component of port/harbor accident. Also, if Lack of periodic maintenance is a core component of port/harbour accident? Out of 100 (100%) respondents, 1.3% disagreed, 42.7% are neutral, and 56.0% agreed that lack of periodic maintenance is a core component of port/harbor accident. When they were asked if Over capacity usage is a major cause of port/harbour accident, out of 100 (100%) respondents, 1.3% disagreed, 46.7% are neutral, and 46.7% agreed that over capacity usage is a major cause of port/harbor accident. They were asked if Fault in design/ construction of machinery/equipment has played a role in port/harbour accident? On their response, out of 100 (100%) respondents, 1.3% disagreed, 30.7% are neutral, 61.3% agreed, while 6.7% strongly agreed that fault in design/construction of machinery/equipment has played a role in port/harbor accident. Also, on the issue if Management carry out safety meetings at regular intervals? Response shows that out of 100 (100%) respondents, 14.7% disagreed, 52.0% are neutral, 32.0% agreed, while 1.3% strongly agreed that management carry out safety meetings at regular intervals. Respondents were asked if accident/near accident reports are recorded by management? Out of 100 (100%) respondents, 20.0% disagreed, 52.0% are neutral, and 28.0% agreed accident/near accident reports are recorded by management. On Accident/near accident report are raised and handled in a satisfactory manner by the management? out of 100 (100%) respondents, 2.7% strongly disagreed, 17.3% disagreed, 36.0% are neutral, and 26.7% agreed that satisfactory manner by the management. Question was also asked if Irregular storage area provided by management is a major cause of port/harbour accident? Response indicates that out of 100 (100%) respondents, 10.7% strongly disagreed, 16.0% disagreed, 33.3% are neutral, 37.3% agreed, while 2.7% strongly agreed that irregular storage area provided by management is a major cause of port/harbor accident. Also, if Failure to consider dangerous goods separation by management is a major cause of port/harbour accident? Response indicates that out of 100 (100%) respondents, 2.7% strongly disagreed, 14.7% disagreed, 33.3% are neutral, 34.7% agreed, while 14.7% strongly agreed that the failure to consider dangerous goods separation by management is a major cause of port/harbor accident. Further questions on if Coordination deficiency by management is a core cause of port/harbour accident? Shows that out of 100 (100%) respondents, 13.3% disagreed, 54.7% are neutral, 26.7%% agreed, while 5.3% strongly agreed that the coordination deficiency by management is a core cause of port/harbor accident and Do you agree that organisational/management factor is a core cause of port/harbour accident? out of 100 (100%) respondents, 1.3% strongly agreed, 10.7% disagreed, 37.3% are neutral, 37.3%% agreed, while 13.3%

strongly agreed that organization/management factor is a core cause of port/harbor accident. They were asked if Unfavourable weather condition played a vital role in the occurrence of port/harbour accident out of 100 (100%) respondents, 2.7% strongly agreed, 5.3% disagreed, 24.0% are neutral, 61.3% agreed, while 6.7% strongly agreed that unfavorable weather condition played a vital role in the occurrence of port/harbor accidents. Finally, the respondents were asked if they agree that environmental factor is a core cause of port/harbour accident? The response indicates that out of 100 (100%) respondents, 5.3 % strongly agreed, 17.3% disagreed, 48.0% are neutral, 29.3% agreed, and that environmental factor is a core cause of port/harbor accident.

To ascertain the rate of port and harbor accidents and its effect on its operational performance. From the study, it was perceived that the rate of port and harbor accidents is high. This implies that it is likely going to affect the performance of operational port indicators. The study is in line with the study carried out by Adewale and Abiola (2020). According to a study conducted by Adewole and Abiola (2020), the rate of port and harbor accidents in Nigeria Port Complex Apapa is relatively high. The study found that between 2015 and 2019, there were a total of 85 accidents in the port complex, with an average of 17 accidents per year. These accidents included collisions, groundings, and fires, among others. The study also revealed that the majority of these accidents were caused by human error, equipment failure, and poor maintenance. The high rate of accidents at the Nigeria seaports has a significant effect on its operational performance. According to Oluwole and Akintoye (2019), these accidents have led to delays in cargo handling and increased costs for shippers and terminal operators. The study also found that the accidents have resulted in damage to equipment and infrastructure, which has further affected the efficiency of the port complex.

Conclusion: The study therefore concludes that technology is a necessity in port security and safety and would help in and around port harbors to reduce the number of port and harbor accidents that occurs in Nigeria's Seaport, as well as to improve the port's operational efficiency. This research also concludes that prioritizing training and retraining of officers and staff by maritime organizations on the efficacy of safety procedures and measures helps to prevent the occurrence of port or harbor accidents. Adequate training would help reduce or avoid the near miss cases of accidents. The NPA shall determine the functional criteria required to achieve the appropriate level of marine traffic safety and efficiency using VTS. Nigeria Maritime Administration and Safety Agency should work harder in the areas of safety and security around our seaports.

Acknowledgement: The authors extend their appreciation to Tertiary Education Trust Fund for funding this research.

Declaration of Conflict of Interest: The authors declare no conflict of interest.

Data Availability Statement: Data are available upon request from the first author or corresponding author or any of the other authors

REFERENCE

Adewole, AO; Abiola, OO (2020). A study of the causes and effects of port accidents: The case of Nigerian port complex, Apapa. *Int. J. Saf. and Sec. Eng*., 10(1), 74-81.

Adegbite, OE; Awodele, OA; Afolabi, AO. (2020). Evaluation of safety practices in Nigerian seaports: A case study of Apapa port. *Int. J. Ind. Saf Eng.*, 9(1), 13-20.

Awal .ZI; Hasegawa, K(2015) Accident analysis by logic programming technique. Safety and Reliability of Complex Engineered Systems: ESREL 2015, pp. 13-21.

Chlomoudis, CI.; Kostagiolas, PA; Lampridis, CD. (2011) Quality and safety systems for the port industry: Empirical evidence for the main Greek ports. *Eur. Transp. Res. Rev*. 2011, 3, 85–93. [CrossRef].

Darbra, RM; Casal, J (2004) Historical analysis of accidents in seaports. *Saf. Sci*. 2004, 42, 85–98

Dayananda SK; Dwarakish, GS (2018): Measuring port performance and productivity, *ISH J. of Hydraulic Eng*. DOI: 10.1080/09715010.2018.1473812

Dutra, A; Ripoll-Feliu, VM; Fillol, AG; Ensslin, SR; Ensslin, L (2015). The construction of knowledge from the scientific literature about the theme seaport performance evaluation. *Int. J. Pro. Per. Magt.* 64 (2): 243–269.

Hamka, MA (2017) Safety Risks Assessment on Container Terminal Using Hazard Identification

and Risk Assessment and Fault Tree Analysis Methods. Procedia Eng. 2017, 194, 307–314

IMO. Our Work: Maritime Safety. United Nations – International Maritime Organization. 2017. http://www.imo.org/.

Kim, H; Han, D; Lee, J. (2018). Analysis of environmental factors affecting berth occupancy in the Port of Incheon. *J. M. Sci. and Eng*., 6(1), 1-11.

Lee, SH; Kim, SH; Kim, HG. (2020). The impact of accidents on port throughput: The case of the port of Busan. *Saf. sci*., 130, 104877.

Manca, F; Pinna, F; Pisano, P. (2019). The impact of accidents on port throughput: an empirical analysis. *M. Pol. Mgt.,* 46(6), 710-727.

Maritime Injury Guide 2022)

Nigerian Ports Authority, (2022). Retrieved from wwwnigerianport.gov.ng

Oluwole, OA; Akintoye, IR. (2019). Port safety management: A case study of Apapa port complex, Lagos, Nigeria. *Inter. J. Eng. Res. and Appl*, 9(4), 1-10.

Wikipedia 2022).

Zhang, J; Li, Y; Liu, Y. (2017). Research on the impact of sedimentation on berth utilization in Qingdao Port. *J. Co. Res.,* 79(sp1), 124-128.