Impact of Human Error on Maritime Industry: Case of Jamaica

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المستخلص

يشكل الخطأ البشري تحديًا كبيرًا في صناعة النقل البحري، مما يساهم في فقدان كثير من الأرواح، والخسائر الاقتصادية، والأضرار البيئية، وتقليص فرص العمل. تبحث هذه الدراسة في تأثير الخطأ البشري على صناعة النقل البحري على المستوى العالمي والإقليمي وفي جامايكا من خلال تحليل بيانات الحوادث لتحديد الأنماط المتكررة والعوامل المسببة. تتعمق الدراسة في العوامل الصحية، والنفسية، والبيئية، والتنظيمية، والتكنولوجية، التي تشكل أساس الخطأ البشري في المجال البحري. ثم يركز البحث على تقديم منظور تحليلي دقيق من خلال فحص بيانات الحوادث البحرية في جامايكا للفترة بين عامي ٢٠٠٩ و٢٠٢٣. تهدف الدراسة إلى تحديد التحديات المرتبطة بالخطأ البشري في جامايكا. تلجأ الدراسة إلى منهجية بحثية مختلطة؛ حيث يتم استخدام طريقة العينة البسيطة أولاً لتحليل ردود المشاركين وضمان مصداقية وحيادية الاستنتاجات التي تم التوصل إليها من البيانات فيما يتعلق بالبحث. من ناحية أخرى، يتم استخدام العينة الهادفة لتحليل الحوادث البحرية في جامايكا وضمان أن العينة تتناسب بشكل وثيق مع أهداف البحث، مما يزيد من دقة وموثوقية بيانات ونتائج الدراسة.

تهدف الدراسة أيضًا إلى تقديم توصيات فعالة للقضاء على الأسباب الرئيسية المسببة للأخطاء البشرية، وتحسين السلامة البحرية من خلال اكتساب المعرفة الكافية بتأثير الأخطاء البشرية على القطاع البحري على الصعيدين العالمي والمحلي لدولة جامايكا. في هذا الصدد، يقدم البحث توصيات ذات صلة لجعل البيئة البحرية أكثر أمانًا لجميع قطاعات صناعة النقل البحري على مستوى العالم وفي دولة جامايكا من خلال تحديد عوامل الخطر الرئيسية وتقديم توصيات فعالة. بشكل أكثر تحديدًا، يتضمن ذلك توصيات لاعتماد برامج تدريب متقدمة للطاقم، والتي يمكن أن تعالج الفجوات المعرفية الموجودة، وإنشاء طرق تواصل أكثر فعالية على متن السفن، وتعزيز وعي البحارة من خلال الحلول التكنولوجية ودعم استدامة/استقرار التوظيف والسمعة للعاملين في المجال البحري. بالإضافة إلى ذلك، تبرز التوصيات إرشادات لتحسين صنع واتخاذ القرارات من قبل الطاقم وتقليل تأثيرات الخطأ البشري. أخيرًا، يقترح البحث نهجًا شاملاً لمعالجة الخطأ البشري من عدة وجهات نظر، مما يؤدي إلى انخفاض كبير في الحوادث البحرية على مستوى العالم، وفي جامايكا، والأهم من ذلك، في مصر.

ABSTRACT

Human error remains a significant challenge in the maritime industry, contributing to substantial loss of life, economic losses, environmental damage and employment reduction. This research investigates the prevalence of human error in maritime operations globally, regionally and in

Jamaica by analyzing accident data for identification of recurring patterns and causal factors. The study delves into the health, psychological, environmental, organizational and technological factors, underpinnings of human error within this complex domain. Then, the research focuses on the maritime industry to provide a localized perspective by examining the data of maritime incidents in Jamaica for the period between the years 2009 and 2023. The study aims to identify the unique challenges and vulnerabilities associated with human error in Jamaica. The research recourses to a mixed-method research methodology; the simple sampling method is first used to analyze participant replies and assure the legitimacy and impartiality of the conclusions reached from the data in relation to the research. Purposive sampling, on the other hand, is used to analyze marine accidents in Jamaica and guarantee that the sample closely fits with the research objectives, hence increasing the rigor and dependability of the study data and findings.

The research also aims to provide effective recommendations to eliminate major contributing causes of human error, and to improve maritime safety by gaining enough knowledge of the influence of human error on the marine sector both globally and in Jamaica. Finally, the research proposes a comprehensive approach for tackling human error from several viewpoints, thus leading to a significant decrease in marine accidents and incidents in Jamaica and worldwide.

Keywords- Human Error, Human factors, Maritime industry, Employment rate, Jamaica.

1- BACKGROUND

The maritime industry is an important facility. It has an obvious effect on the global economy because no other technologies can replace the shipping. It is the most economical means of transporting large quantities of cargoes between different ports around the world. It also includes port operations, oil and gas terminals operations, tug and barge operations, pilotage, chartering of ships, passenger and pleasure operations, vessel classifications, marine insurance, maritime communication with ports or ships, recreational boats and yachts and many other maritime operations and activities, either offshore or onshore. Shipping and shipbuilding have to cope with and fulfil the large developments in the maritime industry requirements for supporting the adoption of maritime conventions, marine insurances, maritime arbitration, and maritime education and training (Daniels, 2024). The demand of building new ships with modern advanced technology has increased in the shipbuilding industry. Therefore, the human element is the most important responsible factor for running all the maritime operations and activities, implementing the international and local maritime regulations, maritime safety, maritime security, modern ship technologies and any other related activities, and is the secret of failure or success for any maritime company (Vedat et al, 2018). Moreover, it is an important factor in improving the maritime safety, commitment from the management level of any maritime organization, effective control and monitoring, maritime training, efficient maritime education and safety culture concept's implementation. Most of the maritime operations look for high quality trained crewmembers to be harmonized in shore-based management and on board ships to enforce safety, environmental protection and competitive ship management. The human elements impact extends to the entire crew activities, shore based management team, shipyards and all personnel related to the maritime operations. The primary aim of the International Maritime Organization (IMO) is to

mitigate the human element impact to enhance the safety of life at sea for crew and passengers on board ships or in the offshore industry, maritime safety, maritime security and marine environmental protection, as dictated by its resolution (A.947 (23), 2003). Studies stated that 75-96% of the maritime accidents in different maritime operations fields occurred due to the human error (Canter, 2024). The human element is a cumulative complex problem, which affects the ships worldwide. It affects the safety of life of the crew on board cargo ships, safety of life of the passengers on board passenger ships and pleasure ships, maritime safety, maritime security, marine environmental protection and safety of maritime operations for different types of ships (Barnett and Pekcan, 2017). The human error types are operational human error and managerial human error based on the role of work of the staff member in any maritime operations. This research study presents the human error impact on maritime safety with application on Jamaica due to the availability and reliability of data and information. Results and methodologies of this research are applicable on Egypt once research data are available due to the important geographical location of Egypt and its enhancement in international supply chain in the maritime industry.

2- METHODOLOGY

The research design used and implemented mixes quantitative and qualitative research methods (Leedy & Ormrod, 2014), with the aim to provide the research with the strengths that can cover the weaknesses of the usage of either method alone. In addition, it provides a full comprehensive coverage and understanding of the research problem. It also aims to conduct a sample survey, using a survey questionnaire consisting of (9) questions to identify the actual causes of human error in the maritime industry in Jamaica.

In addition to the survey questionnaire, interviews carried out with representative of the Marine Investigations Department at the Maritime Authority of Jamaica (MAJ) for relevant data on types of marine incident have been arranged between the years 2009 to 2023. Furthermore, interviews have been conducted with the representatives of the Marine Pilotage at the Port Authority of Jamaica, port operation managers at Kingston port, Montego bay port, Discovery bay port and Falmouth port, marine superintendents of national maritime companies in Jamaica, crewing and manning recruitment representatives and yachts sector representatives.

Data for study of reported marine incidents and causalities for years 2009 - 2023 has been obtained from European Maritime Safety Agency (EMSA). In addition, data has been collected from the International Maritime Organization's data platform (Global Integrated Shipping Information System (GISIS – IMO) for the years between 2009 – 2023 for worldwide maritime incidents and casualties. As also (GISIS – IMO) gathered data assisted in the study of Caribbean region maritime incidents for the years between 2009 – 2023. Data had been collected from the Marine investigation department at the Maritime Authority of Jamaica as it shows the number and types of marine incidents in Jamaica between years 2009 to 2023.

Instruments: The instrument used for gathering the data was a combination of quantitative and qualitative data gathering instruments. The quantitative research instrument used for gathering the

data for the purpose of the research was the survey questionnaire and the qualitative research instrument used for gathering the data for the purpose of the research was the interviews.

Sampling: The sample size of the research consists of fifty-five persons due to their availability and capability at the time of this survey. Fifty persons who are engaged in maritime operations on ships, ports and maritime companies and five persons who are in responsibility of supervision of the maritime safety, marine pilotage, maritime training and education, port operations, yachts, recreation and pleasure activities and crewing and manning of seafarers. The sampling methods used in this research were the simple random sampling method, and purposive sampling method.

The simple random sampling method was selected to ensure that each participant in the questionnaire survey had equal opportunity of selection. The simple random sample of this research was chosen to ensure the credibility and impartiality of the conclusions drawn from the findings as they relate to the research (Leedy & Ormrod, 2005). The Simple Random Sampling Method used for (50) fifty persons who are engaged in maritime operations on ships, ports and maritime companies. According to (Leedy & Omrod, 2005) this sampling method was selected for the interviewees based on particular knowledge, experience and their responsibilities in the maritime industry in Jamaica. The purposive sampling considered (5) five officials who are in charge of the maritime safety, marine pilotage and ports operations, maritime training and education, yachts and recreation activities, and crewing and manning of seafarers in Jamaica. Other officials were also targeted, but their stuffed time schedules and work engagements made it very difficult to meet with them at the time of research.

Method of analysis: Data were collected from the questionnaires and interviews are analysed using descriptive statistics. This descriptive static approach enabled the results to be presented in tables, graphs and other forms of diagrams, as suggested by (Cox, 2017). Analysis was conducted by the use of computer programme Microsoft office Excel 2010).

3- RESULTS AND DISCUSSION

Marine casualties and incidents worldwide: According to the reports of the European Maritime Safety Agency (EMSA, 2023) and Global Integrated Shipping Information System (GISIS – IMO, 2023), Figure (1) shows the number of reported marine causalities and marine incidents between year 2009 – 2022 with different levels of severity. The total number of reported marine casualties and incidents over this period was 30422. The total number of reported marine casualties and incidents in 2022 was 2,510. In relation to the severity in year 2022, 53.3% of the reported marine casualties and incidents were less serious, 24.4 % were serious, 1.7% were very serious and 20.6% were marine incidents (EMSA, 2023).

In addition, Figure (2) shows the number and type of marine incidents and casualties that happened worldwide over the same period. It illustrates that marine incidents caused by collision were 5915, loss of propulsion power 5089, contact with berths 3614, loss of equipment 3400, grounding/stranding due to power failure 2356, fire and explosion 1870 and loss of directional control 1745. In addition, grounding/stranding due to other operational causes like human error

were 1101, flooding 967, loss of containment 939, loss of control power 123, capsizing due to listing 991, hull failure 690 and other operational causes contributing to marine incidents causation 185.

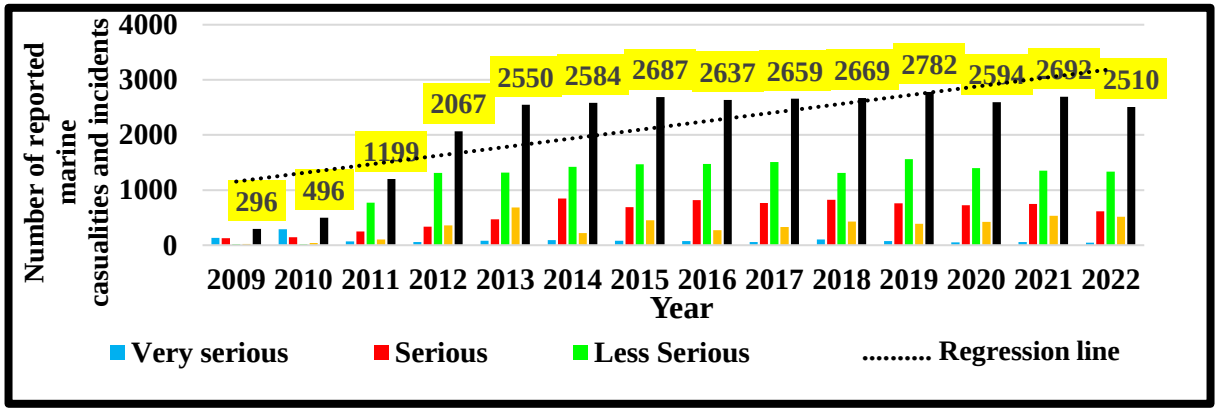

Figure (1): Number of marine causalities and incidents worldwide (2009 – 2022)
Source: EMSA and GISIS-IMO (2023)

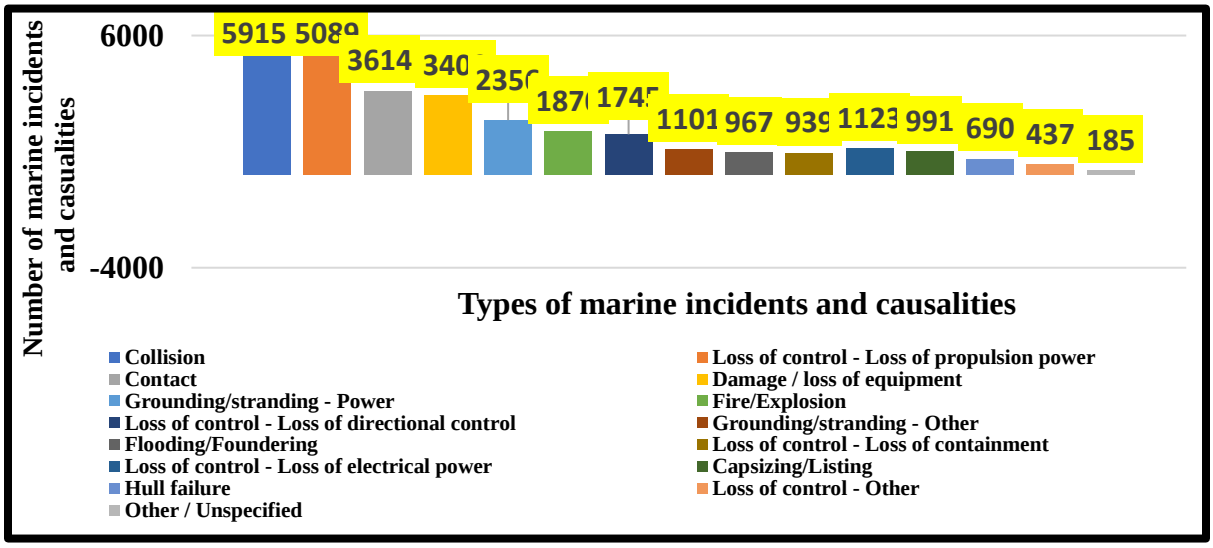

Figure (2): Number and type of marine incidents and casualties worldwide 2009 - 2022
Source: EMSA and GISIS-IMO (2023)

Contribution of Human factor to maritime causalities and incidents: Human actions and associated elements influence accident occurrences. Figure (3) shows the percentage of contributing elements affected by humans, as determined by taking into account all relevant aspects. Between 2014 and 2022, the human element had an average effect of 80.7% on the contributing elements. Fishing vessels have the lowest human effect (76.1%), whereas other ships have the most (87.7%). Cargo, passenger, and service ships have an effect equal to or higher than 80.1% (EMSA, 2023).

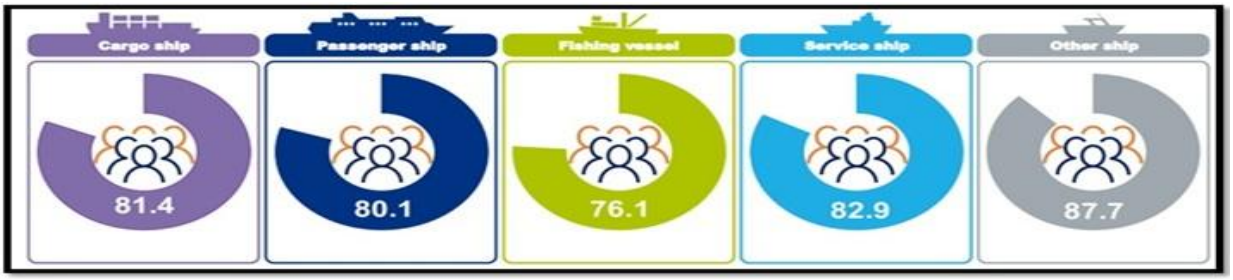

Figure (3): Percentage of human element contribution in marine casualties and incidents
Source: EMSA (2023)

Marine casualties and incidents in Caribbean region: Figure (4) shows that (107) marine incidents affected the Caribbean region including Jamaica between the years 2009 – 2023 with different types and impact. It indicated that marine casualties and incidents increased in years 2012 and 2016 with fifteen and thirteen incidents, respectively, due to improper implementation of safety procedures on board and lack of organizational supervision.

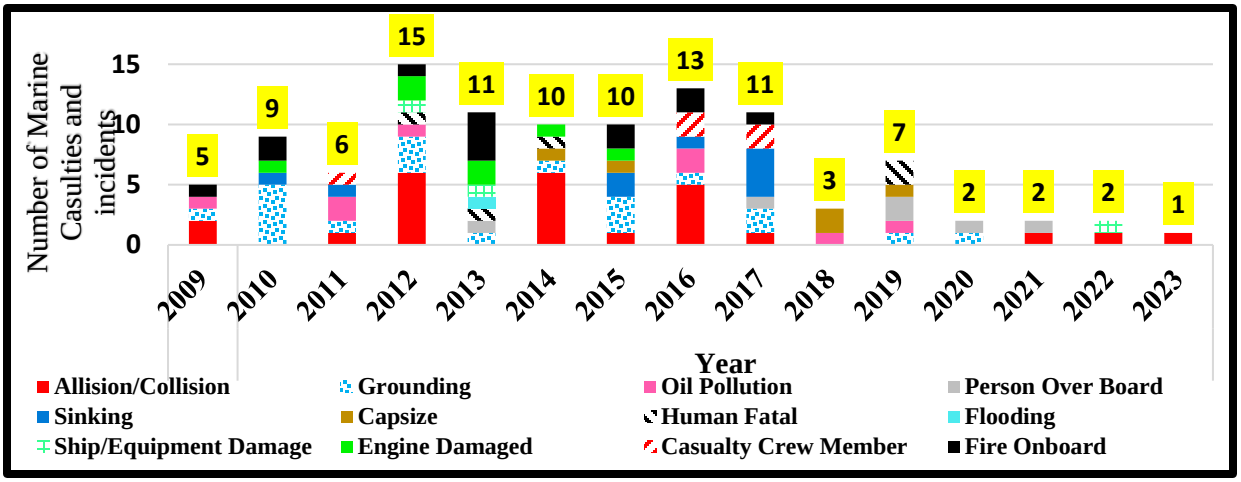

Figure (4): Number of marine incidents in the Caribbean Region
Source: GISIS - IMO (2023)

Some (107) marine incidents affected the Caribbean region including Jamaica as follows: (25) allision/collision, (20) grounding, (8) oil pollution, (5) casualty of crew members on board ships, (13) fire, (6) person overboard, (9) sinking of ships, (5) ships capsize, (5) human fatal, (7) engine damage, (3) ship/equipment damage and (1) flooding. Data analysis showed a sensitive and tangible contribution of Jamaican marine incidents to the Caribbean region marine incidents.

Marine casualties and incidents in Jamaica: Figure (5) shows that between 2009 – 2023 a total of forty marine incidents and casualties happened with various types between allision/collision at the years 2012, 2014 and 2016. The grounding incidents have increased in 2010; oil pollution has increased in 2011 and 2016, incident affected crewmembers increased in 2016 and 2017 and fire on board incidents increased the years 2015 and 2016. Figure (6) illustrates that 37.5% of marine incidents were allision/collision, 25% grounding, 20% oil pollution, 12.5% affected crewmembers and 5% fire on board ships.

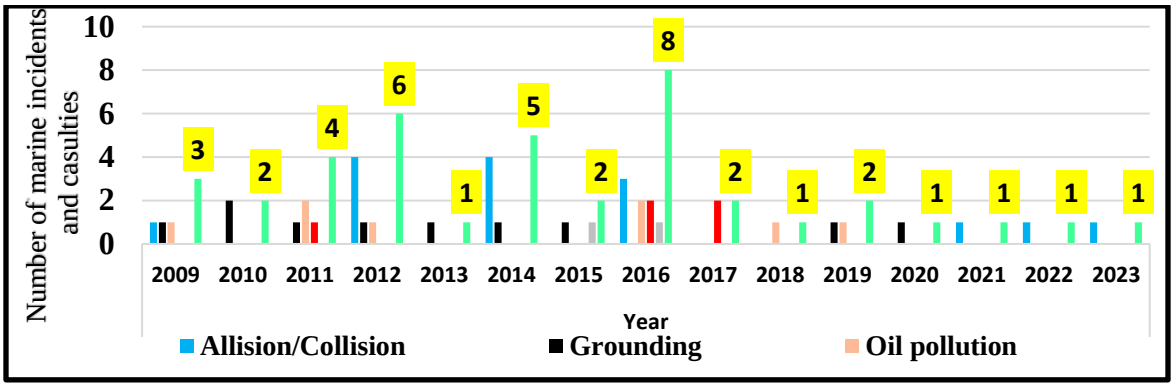

Figure (5): Number of marine incidents and casualties in Jamaica 2009 – 2023

Source: Maritime Authority of Jamaica (2023)

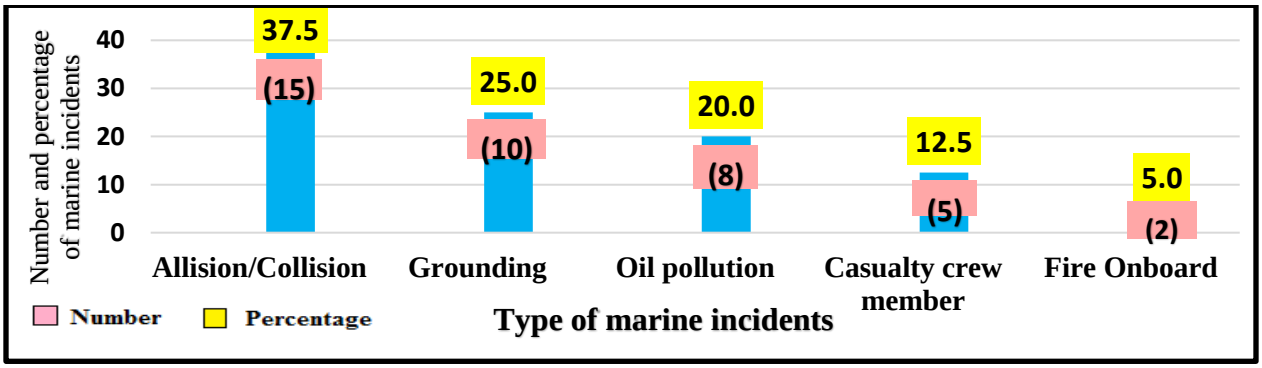

Figure (6): Frequency of marine incidents in Jamaica 2009 – 2023

Source: Maritime Authority of Jamaica (2023)

Contribution of Marine Incidents in Jamaica to those in Caribbean Region: Figure (7) illustrates the numbers of marine incidents in Jamaica as effective factor in Caribbean region marine incidents.

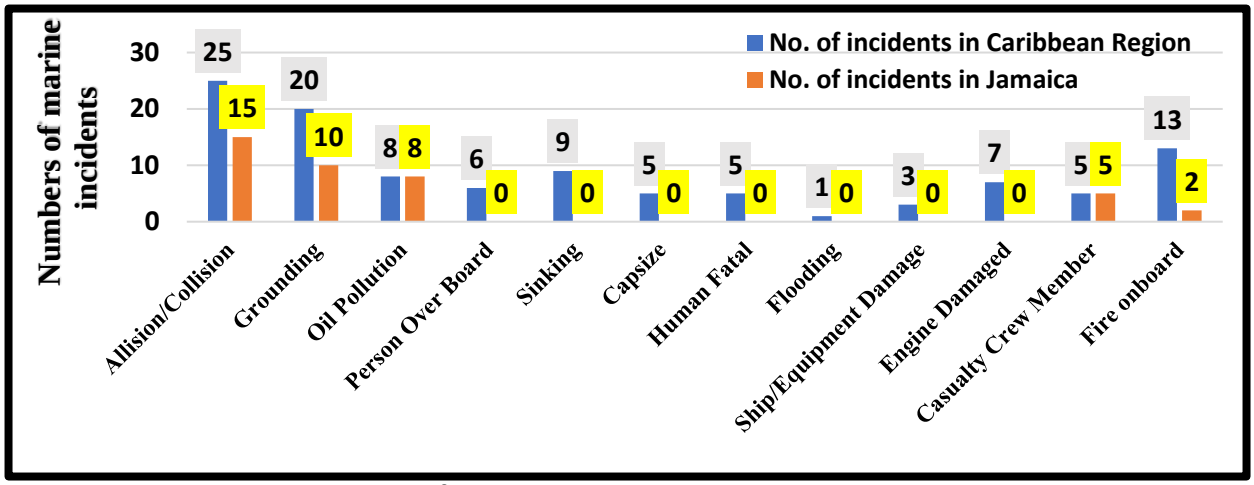

Figure (7): Number of marine incidents in Jamaica and in Caribbean region

Source: GISIS - IMO (2023)

Note that the (15) allision/collision marine incidents in Jamaica represent (60%) of the total number of this type of incidents in the Caribbean. Similarly, grounding marine incidents (10 in Jamaica) represent (50%). On the other hand, Figure (7) indicates that (100%) of oil pollution marine incidents (8 incidents) and casualty of crew members on board ships (5 incidents) occurred in Jamaican waters. Also, (2) fire incidents in Jamaican waters, out of a total of (13) fire incidents in the Caribbean region, represent (15%).

Questionnaire findings: Research questionnaire surveyed different occupational sectors, which give the results for reliability and validity to answer the research questions. Participation to questionnaire survey conducted by experienced persons, which give more accuracy to the research results. Local maritime sector experience made the survey reached deeper to explore the actual causes of marine incidents in Jamaica. Different maritime work sectors helped the researcher in investigation and exploration of marine incidents causation and contributing factors leaded to those incidents. The survey showed that lack of training and maritime education mostly the main factor in causation of marine incidents. In the same time, lack of maritime education and training could be considered the opening gate for occurrences of the other factors such as organizational and managerial factors, unsafe supervision, environmental factors, ship's design factor and lack of communication which indicated by participants.

Survey shown in figure (8) that human error has a clear participation in marine incidents causation by 51% - 75% according to questionnaire survey. Participants indicated that marine incidents caused damage to the ships, ports constructions and equipment, marine pollution affected Jamaican ports. In addition, it caused casualties and loss of life to related staff. In addition, it has an economic impact on the local and regional maritime industry and a clear impact of the reputation, employment rate and competitiveness of seafarers.

Human error causation is mostly due to lack of training and maritime education, workload and fatigue factors, skills factors, organizational factors and commercial pressure. Figure (9) shows a clear indication of statements that human error reduced the employment rate of seafarers and shore personnel jobs. Also, it affects the seafarer's future and on shore operators employment sustainability.

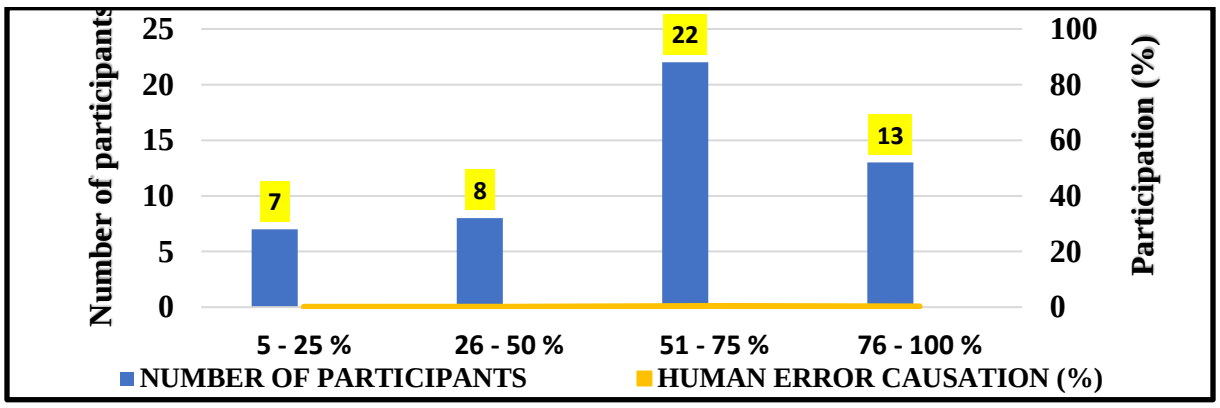

Figure (8): Causation of maritime accidents in Jamaica
Source: Author (2024)

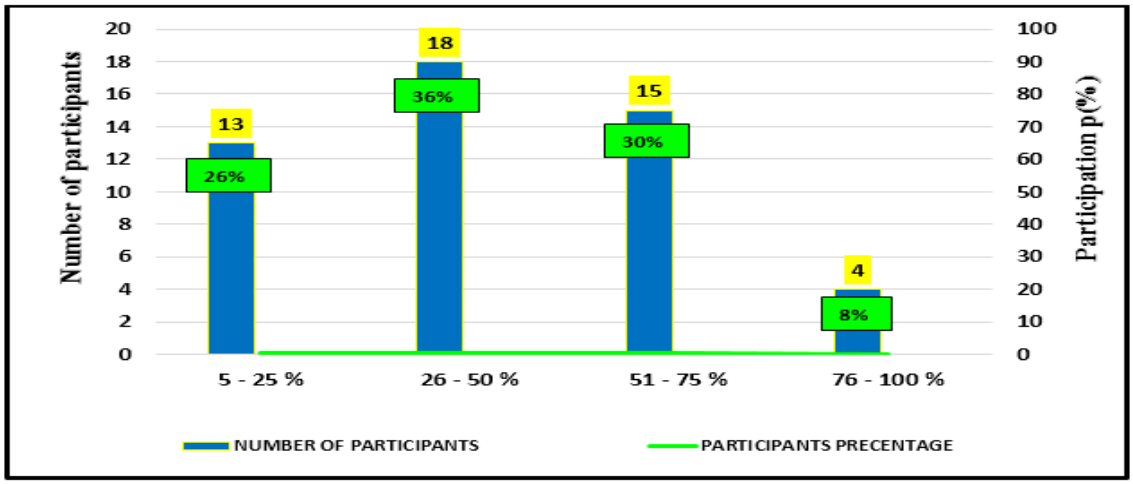

Figure (9): Effect of human error in employment rate reduction in Jamaica percentage
Source: Author (2024)

Interview findings: Figure (10) shows that two interviewees attribute causation of marine incidents in Jamaica primarily to lack of seafarers maritime education and training. While lack of organizational procedures, managerial supervision, environment and weather condition effects, inadequacy of ship design, and communications and language barriers were individually judged as the primary cause by one interviewee only. Furthermore, four interviewees are of the opinion that human error is the primary factor in marine incidents in Jamaica.

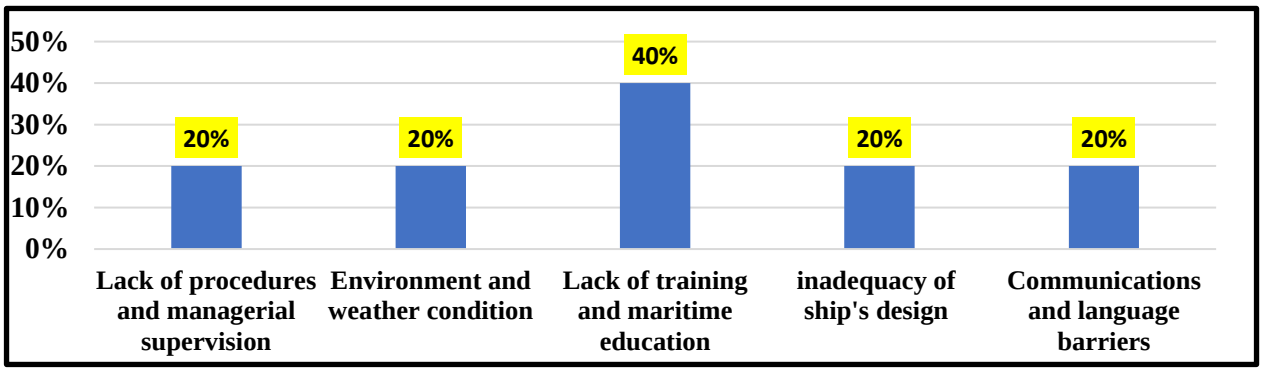

Figure (10): Causation of Marine incidents in Jamaica
Source: Author (2024)

Referring to Figure (11), one interviewee sees that workload, stress and fatigue are the main causes of human error. In addition, two interviewee thinks that lack of teamwork, knowledge, training, knowledge, experience and communication barrier are the most influential contributing factors. While one interviewee states that lack of organizational policies, crew resource management, and supervision are the main causes of human error initiation; he also sees that the commercial pressure induced by focusing on profitability is one of the vital causes of human error.

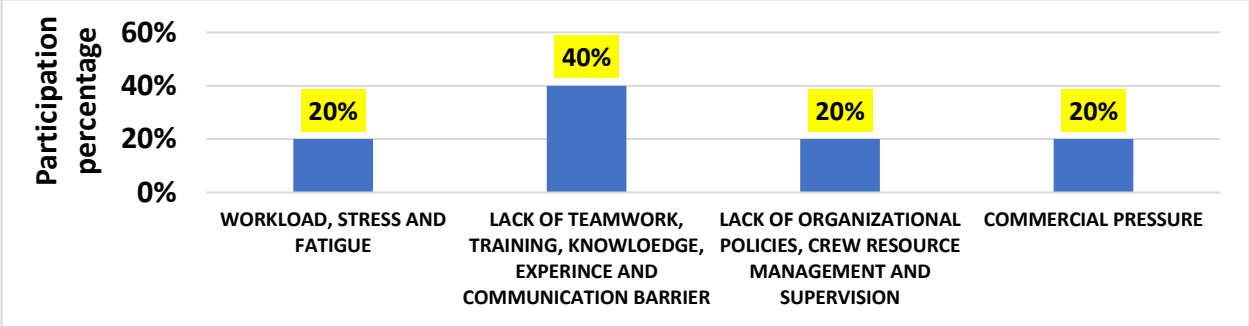

Figure (11): Percentage participation of human error sources in the marine incidents in Jamaica

Source: Author (2024)

Figure (12) shows that two interviewees addressed the negative impact of human error on seafarers' life, three pointed to the negative impact on damage to ships, ports construction and equipment, three mentioned the economical, three confirm the negative impact on reputation and competitiveness, and two maximize the effect on marine pollution.

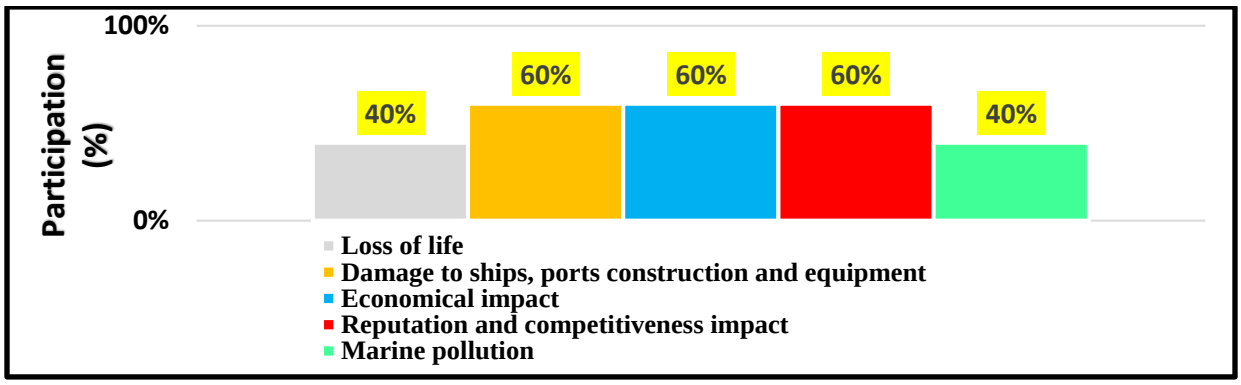

Figure (12): Human error impact on maritime industry in Jamaica

Source: Author (2024)

Moreover, the interviewees' opinion differed when it came to the effect of human error on employment rate. Whereas three interviewees assigned a weight of (51-75%) to that effect, one interviewee only assigned a weight of (5-25%) and another assigned (26-50%), as shown in Figure (13).

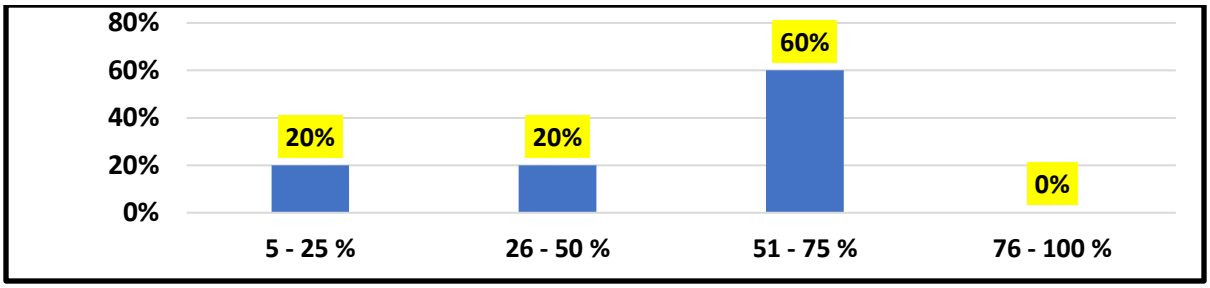

Figure (13): Effect of human error in employment rate reduction in Jamaica percentage

Source: Author (2024)

Three of the interviewees indicated that some procedural measures have been taken in some of the maritime shipping companies to reduce the inlet of some contributing factors of human error such as checklists, work permits, monitoring and supervision systems but effective implementation of those procedures is yet to be enforced. Also, shortage of financial resources in some of maritime companies and the limited view of those companies toward the profitability of such procedures retard their activation. In addition, two of the interviewees see that the overlooking and delaying of maritime companies' managers to decide in investment of their workers or crew through maritime training and education made the efforts of human error reduction techniques unfruitful.

4- CONCLUSION

The study highlights the importance of human error in marine incidents and the need for a comprehensive approach to safety management. The Jamaican marine industry shares vulnerabilities with other international sectors, such as poor training and resource restrictions. To reduce these risks and promote a sustainable marine economy, a diversified strategy is required, including better training, strengthened safety rules, and enforcement. The study found that human error in maritime incidents in Jamaica is a fact, primarily due to a lack of training and maritime education. Other factors such as organizational and managerial factors, unsafe supervision, environmental factors, ship design factors, and lack of communication also contribute to these incidents.

The limited awareness of human error causation and impact in marine incidents in Jamaica suggests the need for more effective measures to mitigate this issue. Recommendations include training maritime companies' managers on professional leadership, supervision, and motivation, as well as addressing the commercial pressures of some managers. Strategic investments in technology and a strong safety culture that prioritizes error reporting can help minimize accident risks while protecting the marine environment and the livelihoods of seamen and port operators. By promoting a culture of safety and reporting, the marine sector can make significant gains in minimizing human error effects while maintaining the environment and seafarers' lives.

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