

Evaluation and Prioritization of Effective Factors in the Crisis Management of Marine Hazards in Makran Coast in Sistan and Baluchestan Border Guard, Chabahar Marine Security Base

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Abstract

INTRODUCTION: Nowadays, the management of marine hazards has been taken into consideration by the authorities of marine organizations. This issue is important for preventing accidents, reducing costs, controlling socioeconomic harms, and maintaining professional human resources.

METHODS: This exploratory descriptive study was performed as a survey with applied objectives. Library research was used to gather information and data collection was completed through the field method. To this aim, a researcher-made questionnaire was applied following the presence of the researcher in the target population. The validity was confirmed according to the ideas of professionals in this field and the reliability of the questionnaire was assessed by Cronbach's alpha using the SPSS software (version 22).

RESULTS: The results of the research demonstrated that the highest frequency was for the age group of 31 to 40 years. In terms of experience, we observed that the highest frequency was for the age group of 6 to 10 years. In addition, the highest frequency of educational level was found for the associate degree with 141 people. Regarding the employment location, 58 individuals were center staff and 176 people were operational. In addition, data analysis showed that management factors, human error, training, inspection, and monitoring, in addition to physical, and environmental variables, information system, guidelines, specialized technologies, facilities, and support affect the management of marine hazards in the Makran coast.

CONCLUSION: The results of ranking and prioritizing of effective factors in marine hazards management utilizing the Friedman test showed that guidelines, training, management, human errors, specialized technologies and facilities, support, inspection and monitoring, information system, and physical and environmental variables were reported as the first to eighth ranks, respectively.

Keywords: Chabahar Marine Security Base; Crisis Management; Makran Coast; Marine Accidents; Marine Hazards.

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Introduction

Considering the position of the Islamic Republic of Iran (IRI) with long maritime boundary and over 2700 km coastline and despite all the efforts for decreasing marine

accidents through improving the quality of ship security and enhancing training level for the crew, shipping industry encounters various accidents yearly, which result in the death of people in some cases. Experience indicates that in several cases, the presence of trained forces and suitable

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facilities ready for the mission of search and rescue (SAR), as well as sufficient support for the mission could rapidly diminish the human injuries caused by these accidents (1).

The security and protection of the land and maritime borders of IRI is among the most important tasks of the police force of the country, for which the frontier control commander is responsible. The marine security (coastguard) is also under the supervision of this unit and is responsible for the protection of seas and coasts and the security of the shipping lines (2).

Any organization is faced with diverse crises during its life. Therefore, commanders, managers, and the major decision-makers of organizations should consider arrangements to always have their settings prepared for facing possible disasters. The best action to take is the effective adoption of crisis management. Consequently, security and remaining in the sea depend on our knowledge of sea, suitable and efficient facilities with proper application, training and attained skills, physical power, mental status, and familiarization with different urgent conditions.

Any accident or condition leading to danger or damage for the vessel or its crew is known as urgent conditions that might lead to the sinking of the vessel and the crew has to leave it. One of the critical and important points in an accident is that the person in danger should have sufficient knowledge for rescue in that condition.

On 17 April 1988, Sahand and Sabalan destroyers and Joshan fast craft attack had a battle with the American warship in the Persian Gulf. When the mentioned units were attacked and sank by tens of missiles some of the crewmembers died or were injured. However, many of those who survived managed to save themselves and other injured individuals in that critical conditions applying their skills and facilities until the arrival of the rescue team (3).

The management of marine hazards has always been considered by the authorities of maritime organizations as the main approach for reducing the costs and socio-economic harms. In order to propose a better plan for minimizing the damages caused by marine hazards, first, a comprehensive understanding of the economic and social impacts of the hazard is required (4).

As a result, it is of high importance to evaluate and prioritize the effective factors in crisis management in Makran coasts to diminish the

damages and mortality and obtain the maximum proficiency and efficiency. Furthermore, it could be useful for planning before and after the crisis by the managers of maritime organizations.

To minimize mortality and damages, we should identify the factors influencing marine hazards and prioritize their economic, social, and critical impacts. Consequently, the present investigation aimed to evaluate and prioritize the influential factors in the management of marine hazards in Makran coasts.

Toomaj and Irej (2018) conducted research titled Identification and Prioritization of Factors Affecting the Crisis Management of Marine Hazards (Case Study: Chabahar Ports). They noted that all of those involved in various fields involved in crises consider the crisis management of marine hazards and natural disasters and emergencies based on a scientific method (5). However, identification and prioritization, finding responses, proposing suitable approaches, preparation, and coordination before a disaster, correct management at the time of crisis, simulating accidents, and identifying the effective factors in their occurrence along with providing practical approaches after a disaster are needed.

Moreover, it is important to compile common practices, define simulated maneuvers and scenarios, and use novel equipment and technologies of SAR toward improving the practical power of organizations. These authors believe that developing the culture of workplace safety, enhancing the level of practical specialized training, and crisis management training could be useful in promoting the quality of marine SAR for reducing human error, injuries, and economic loss.

Therefore, the factors identified to play role in the accidents of Chabahar harbor were categorized in the five groups of management, human error, training the guidelines, inspection and monitoring, and physical and environmental variables.

Mousavi (2016) completed his crisis management PhD. dissertation as Proposal of a Model Concerning the Reduction of Crisis in Marine Hazards. He stated that to diminish the risk of marine accidents and the following crises, human, managerial, technical, and environmental variables should be taken into consideration based on their importance. Among the mentioned factors, human variables were related to 74% of the accidents. The most remarkable scientific

approaches for decreasing marine accidents and crises entailed training human resources, inspection and evaluation, new and advanced facilities, and environmental diagnosis (6).

Khodadadi didani (2011) conducted his marine shipping Master thesis on Human Role in Marine Accidents and the Method of Decreasing Human Errors in Iran Shipping Companies. He concluded that four factors had the most impact on marine accidents, ranked as neglect, insufficient training, insufficient software and hardware tools, and insufficient skill and experience (7).

Esmaili et al. (2007) performed research titled Risk Evaluation of the Repeated Marine Accidents using a Database Designed in the Project of Bandar Imam Khomeini Port Crisis Management. They observed that accidents and crises are a part of human life and are inevitable even with scientific and technological advances. Decreasing the negative impacts of crises is possible through identifying the procedure of crisis management and the preparation and implementation of programs proportionate to the special conditions of each chaos. Compiling preventive programs and responding to probable crises might result in reduced damages and sufficient preparation for facing urgent conditions in the employees (8).

Eshaghi et al. (2016) believe that preparation for encountering urgent conditions not only reduces vulnerability and the consequences of emergency cases but also allows the organizations to learn how to face these conditions. Communications and coordination between members and compiling a written comprehensive crisis management plan are among the major components of preparation against urgent conditions (9).

Literature Review

Iran with long coasts in north and south, about 2700 km of marine borders and oil and gas resources are among the countries that should consider sea economy and maritime industries because these industries are in close relation with national security and economy. Sea is a divine blessing and not taking into consideration the marine economy might be accompanied by remarkable damages to national benefits and our economy (10).

According to the studies performed in diverse sea regions, the main reasons for marine accidents

encompass collision with other vessels, grounding, fire explosion, damage, and foundering. The most important cause of these accidents is considered as human error. It should be noted that the human factors affecting the occurrence of an accident result from a series of associative organizational variables. Consequently, these human errors are inevitable unless the structural problems inside the system are solved.

In this regard, labor hardship, inadequate training, and the lack of a security management system or improper execution of such systems could be named. Therefore, the monitoring role of national marine authority affects the reduction of marine accidents. These roles include recording, evaluating, and analysis of accidents, recruiting trained crew based on the International Convention of Standards of Training, Certification, and Watch keeping for Seafarers (STCW), providing suitable working conditions for seafarers, improving the security of structure, equipment, and facility (11).

Crisis Management

Tabarsa (2003) considered natural accidents in his definition of crisis management. He believes that crisis management refers to coordinating the efforts consciously along with the optimal application of human resource and technical, financial, and non-financial capacity. The approach for crisis management is designing a series of programs and activities before, during, and after crisis as the maximum efficiency and efficacy of rescue mission is obtained in accidents and disasters (17).

One of the mistakes that easily occurs in crisis management is that it is assumed that one solution exists for all crises. However, different plans and solutions are needed for control because they originate from diverse sources and distinct factors play a role in their occurrence (18).

Tasks of Managers in Crisis

The most important parts of crisis management entail reducing the negative effects of the crisis, preparation, and improving conditions after a crisis. A comprehensive crisis management system evaluates potential risks and existing resources and designs plans as balances the resources with the risks to control the crisis using the resources. The major tasks of managers in a crisis include (19):

1. Planning for preventing and diminishing

the influences of an accident and preparation for facing a disaster

2. Attracting public participation for preventive activities, reducing the effects, preparation, and facing the accidents

3. Organizing and developing organizational structures specific to crisis management

4. Recruiting human resources from the mission level to directing level

5. Leading preventive activities, reducing the effects, preparation, and facing the accidents

6. Monitoring and controlling the activities of crisis management

It is of great importance to take preventive management into consideration in the novel science of crisis management. Moreover, scientific and efficient management of accidents without emphasis on prevention and reduction of effects is impossible (20). Therefore, crisis management is based on risk analysis (prevention from disaster), preparation against disaster (before the crisis), emergency aid (during the crisis), and reconstruction (after the crisis) (21).

In this regard, planning has been proposed as the fundamentals of crisis management and is considered as the main process in the crisis management cycle. A suitable plan helps to achieve the intended organizational targets and executive backgrounds for crisis management using maximum power and wasting minimum resources. Regarding the importance of this issue, in case of the lack of proper scientific and operative management in facing unexpected accidents, the rate of human injuries due to disasters will be several times higher. Defect in technical science due to weak planning, organizing, coordination, and control has always been among the key reasons for not achieving the pre-determined targets (22).

History of Crisis and Crisis Management

The term crisis was first proposed by Robert McNamara at the time of probable missile conflict between the USA and Cuba. He stated there is not something as approach anymore and it should be regarded as crisis management (23). Furthermore, crisis management in natural disasters was first introduced in 1989 by Dr. Frank Press at the eighth world conference on earthquake, USA. In Iran, despite the act of preventing and facing flood hazards was passed on June 6, 1969, but officially, since 2004, the

Crisis Prevention and Management Headquarters for Natural and Unexpected Disasters was established (24). Moreover, after that, in 2007, the Iran's crisis management law was approved by the parliament, and it was formed as an organization (25).

Specialized Committees for the Four Steps of National Crisis Management

Crisis management organization consists of 14 specialized and operational committees as follow:

1. Committee of telecommunication for which the Ministry of Information and Communications Technology is responsible.

2. Committee of Health and treatment for which the Ministry of Health and Medical Education is in charge.

3. Committee of drought, chilling injury, and agricultural hazards (culture, gardening, ranching, aquatics, and poultry) for which the Ministry of Agricultural Jihad is responsible.

4. Committee of shipping, critical lines, atmospheric disasters, and storm for which the Ministry of Roads and Urban Development and the center of researches are responsible according to the executive guideline of the law for the formation of National Crisis Management Organization.

5. Committee of non-governmental organizations (NGOs) for which the Ministry of Interior and the director of the Department of Social-cultural Affairs and the council of the Ministry of Interior are in charge.

6. Committee of insurance, reconstruction, rehabilitation, supply and distribution of machinery, debris removal, firefighting equipment, dangerous materials, and transfer and burial of deceased people for which the Ministry of Interior, the director of the Department of Construction Affair, and the director of the Organization of Municipalities are responsible.

7. Committee of security and regulations for which the Ministry of Interior and the head of the Security Department of the Ministry of Interior are responsible.

8. Committee of the flood, marine hazards, electricity, water, and waste for which the Ministry of Energy is in charge.

9. Committee for supplying fuel and oil materials for which the Ministry of Petroleum is responsible.

10. Committee of the earthquake, earth layers

sliding, buildings, and urban development for which the Ministry of Roads and Urban Development is in charge.

11. Committee of house provision for which the Ministry of Roads and Urban Development and Islamic Revolution Housing Foundation are responsible.

12. Committee of environmental hazards for which the Department of Environment is responsible.

13. Committee of education and information for which the Islamic Republic of Iran Broadcasting is in charge.

14. Committee of aid and rescue and public education for which the Iranian Red Crescent Society is responsible (26).

A Review of Marine Accidents and Hazards in Iran and World

The MV Sanchi tanker belonging to the National Oil Tanker Company of the Islamic Republic of Iran loaded a cargo of 111510 tons of condensate (very toxic and with very high flammability and evaporation) left the port of Assaluyeh, Iran for the port of Daisan in South Korea on December 16, 2017, with 32 crew members (30 people with Iranian nationality and 2 Bangladeshis) and on January 7, 2017 at 19:55 local time at a speed of 10 knots (approximately equivalent to 18.55 km / h) collided with a bulk ship belonging to CF Crystal China, which was loading a 64,000-tonne shipment of soybeans from the US port of Kalama on December 15. It was occurred 300 miles from China's Shanghai port, and due to the severity of the accident and having oil cargo, the fuel tanks caught fire and were exploded, so the ship sank at a depth of 115 meters. The SAR and firefighting operation to rescue its crew lasted nearly 10 days due to the extent of the fire and the continuous explosions of the fuel tanks, and finally all 32 crewmembers of the Sanchi ship lost their lives and only the bodies of 3 people were found at the scene. In addition, the rest of the bodies disappeared (27).

The director general of the Ports and Maritime Organization said: In the final report presented by the Sanchi Accident Investigation Committee, all interested countries were blamed for the collision, and according to maritime laws and regulations, two ships are to blame for manpower errors. He added: In terms of distance from the accident site to the nearest shore, as well as bad weather

conditions, the first rescue vessel started the rescue operation 15 hours after the accident (28). As a result, in addition to manpower errors, the delay of search and rescue team in this terrible accident has been effective.

According to the world statistics of disaster, approximately 5640 large shipping accidents have been reported during 1900-2018. A total of 242312 people died in these accidents. Marine accidents accounted for about 1405 cases of these accidents in which 103596 individuals deceased. In other words, the mean number of people dying in large marine accidents was about 73 people. This number has been 46 and 45 for large air and rail accidents, respectively.

Since 2000, 615 large marine accidents have been reported in the world and 42261 individuals died. Only in 2017, more than 41 big maritime accidents occurred in the world and a total of 1502 people died. This year, the highest number of accidents belonged to Asia followed by Africa. The highest mortality rate was in the seas of Libya following the sinking of the boats that were transferring illegal immigrants.

In one of the cases, over 535 people died. Transfer of oil and the products of oil and gas through the sea is one of the cheapest shipping methods for these products. Although marine shipping is one of the most secure methods of shipping, accidents still occur in this industry (29).

The need to equip the Search and Rescue Operations Center and other maritime organizations related to maritime rescue to modern technologies and the location of search and rescue centers near the shipping channel to the center of Chabahar is very important. Many accidents are observed every year in the maritime industry and the high costs it leaves to the owners of goods and transport operators and the maritime community. The staff and vessels of all maritime organizations are no exception to this rule and accidents and Marine hazards that occur for a variety of reasons, in addition to the financial burden on the organization, will cause the threat and occurrence of injuries, casualties and waste of human resources of the marine specialist. Therefore, by controlling and preventing and training to deal with unexpected accidents and crises and minimizing the costs of crises, it is possible to attract the trust of investors, increase the credibility of the organization and play a significant role in the development of this

industry(1) .The final report of the second meeting of the Asia-Pacific Search and Rescue Task Force, held by the International Civil Aviation Organization on January 14, 2014 in Singapore, it was stated that among the operations conducted worldwide in 2012, marine search and rescue operations were 0.048, ground search and rescue operations were 0.030 and air search and rescue operations were 0.022 (30). It indicates a higher number of maritime accidents than land and air accidents. Therefore, it shows the ability of the Marine Search and Rescue Teams and the readiness of the operational units of other Marine Organizations to respond to disasters and rescue services at distress at sea.

Makran Coasts Location

Makran Sea (or Oman Sea) is located as a triangle between the countries Iran, Oman, and Pakistan. The maximum length and width of it from northwest to southeast and from northeast to the southwest are about 950 and 340 km, respectively. Oman deep sea is connected to the Persian Gulf through the Strait of Hormuz and is widely and directly connected to the Arabian Sea and the Indian Ocean and is regarded as a deep sea with a depth of over 3400 m.

The maximum water depth of Iran coasts is more than 2000 m and the length of Iran coastline adjacent to the Oman Sea is about 637 km. Iran Oman Sea coastal plain extends from Bandar Abbas in the Strait of Hormuz to Gwadar Bay on the border with Pakistan. Oman Seawater has the mean salt of 0.037 and the maximum and minimum surface temperature of water in August and January are 32°C and 19.8°C, respectively.

The most important ports of Iran in Makran coasts include the commercial ports of Shahid Beheshti and Shahid Kalantari and the fishing ports of Hafte Tir, Ramin, Beris, Pasaabandar, Gwadar, Tis, Konarak, Pazm, Tang, and Kalat, in addition to the military ports (31).

Effective Factors in the Crisis Management of the Marine Hazards of Makran Coasts

1. Managerial Factors: Weakness in organizing accident directing system and the knowledge of crisis management due to insufficient resources of marine crisis management, not being familiar with urgent conditions, weak professional marine information, insufficient dominance of

managers concerning the executive guidelines of maritime organizations, and recruiting inexpert managers (e.g., the committee of the flood, marine hazards, electricity, water, and waste with one person managing different parts with unrelated specialized tasks and the management should be devolved to the executive managers of highest ranks in maritime organizations).

2. Human Error: This category includes personal errors, namely the lack of correct security management execution, not using personal protective equipment during sailing, not having personal skills for the organizational tasks, bad climatic conditions, the difficulty of marine work which is accompanied by physical burnout (lumbar disc herniation, knee and neck arthritis, the effects of radar radiations, and pulmonary problems). Job dissatisfaction due to familial problems, economic issues, low salary, service guidelines, long sailings without recreational facilities that induce psychological influences, low experience in maritime job domain, and incoordination at the time of the accident are the factors that lead to accidents.

3. Training: Formal reports of human resource training, the low quality of supplementary and specialized maritime training because of focusing on theoretical training and weak practical education due to high costs, weak practical training of educational managers, issuing training certificates, especially for helmsmen and sailors by the educational managers without following the training standards of the detailed program and the International Maritime Organization. Deficient specialized trainers because of the costs of dispatch. All the professional maritime training at the beginning and during work should be practical and experienced trainers and professionals of maritime organizations (army, ports, and maritime universities) should be recruited. Moreover, training scenarios and maneuvers along with the contents of educational courses should be compiled and exercised regarding marine accidents by identifying the educational requirements.

4. Inspection and monitoring: In this category, the most important variables affecting the occurrence of accidents entail the simplicity of control and inspection, not applying the monitoring techniques, information technologies, and novel security facilities, the lack of

specialized certificates defined based on the capacity of the vessel, and not constantly monitoring the maritime classes which are held by the centers of maritime education for issuing sailing certificates.

5. Physical and environmental factors: The lack of specialized piers, insecure and old facilities, not recruiting professional experienced forces in navigation, and not applying new facilities in organizational vessels are known as the most important factors of accidents.

6. Information system: Information system is an organized set of aims, decisions, policies, and planning for organizing the information centers and guide and monitor the information of units, institutes, and information services (Information Commission of National Scientific Researches Council). The information system is a collection of related forces and organizations that provide the special needs and varying capacities of users (UNESCO). Information technology is referred to as a set of tools, machines, knowledge, methods, and skills utilized for the production, transfer, process, preparation, and usage of information. Information policy is a set of policies, plans, strategies, and tactics that lead all the information activities and other related activities toward the determined aim under the framework of public policies and in line with other special policies, especially the scientific, technical, research, and educative policies.

7. Guidelines: Not compiling some rules based on the guidelines of IMO, International Labor Organization (ILO), marine accidents committee, marine conventions, maritime security guidelines, marine crisis management guidelines, and the principles for the salary and benefits of the employees in marine borders affect the incidence of marine accidents. Furthermore, weakness in the localization of important and vital notes in the navigation field toward the organizational objectives, the weakness of commanders for executing the guidelines of dispatching vessels to sea, and the lack of knowledge concerning the guidelines of training centers play remarkable roles in the occurrence of marine hazards.

8. Specialized technologies and facilities and support: Development of communication networks and the importance of information in social life have been the source of new changes in human life. Information technology is a branch of

technology that allows the study, usage, process, manipulation, transfer, management, and control of data as automatic saving grounds applying hardware software, and network. Numerous accidents occur daily in different transportation parts leading to high costs. Investigation of each marine accident is aimed to explore the causative reasons and factors, benefit from the experiences, and try to prevent the incidence of similar accidents in the future by distributing the findings. Moreover, it is essential to apply the proposed recommendations for educational objectives and modify the structures and rules for improving marine security (32).

Importance of Investigating Marine Accidents

1. Accurate inspection and analysis of marine accidents result in higher knowledge concerning the reasons. In addition, the modification of management procedures in vessels and suitable training for promoting marine security are among other outcomes of maritime accidents (33).

2. Any accident from minor to major issues can be the subject of investigating marine accidents. A simple accident for someone on a ship, which can be a potential training for others and prevent reoccurrence might worth investigation. However, a large collision due to the incorrect execution of maritime rules may not have any new thing for learning. Findings of evaluating other collisions might determine that assessment and considerations are required in terms of job burnout, management procedures, training, certificates, and designing a commanding bridge (34).

Therefore, the experiences of sailors who experienced accidents and designing diverse scenarios for marine accidents and hazards recorded by the experts of the Maritime Accidents Committee of IMO could be useful. Furthermore, the formation of specialized committees for marine accidents in maritime organizations, using specialized marine researches of universities and maritime organizations, and signing contractions with them for maneuvers and common practices are necessary. These practices concern the assessment of strong and weak organizational points that are important in enhancing the power and on time reactions of forces during crisis management and marine hazards.

On 17 April 1988, Sahand and Sabalan destroyers and Joshan fast craft attack had a battle with the American warship in the Persian Gulf.

When the mentioned units were attacked and sank by tens of missiles some of the crewmembers died or were injured. However, many of those who survived managed to save themselves and other injured individuals in that critical conditions applying their skills and facilities until the arrival of the rescue team (16).

Safety, security, and protection from the

marine environment are determined as the main aims of the IMO and ranking institutes and the planning of the international maritime industry is aimed at these objectives and considers the economic benefits. However, marine accidents have always affected sailing, seas, and related

Table 1. IMO classification of marine accidents types (10)

| Accident type | Collision | Definition |
|-----------------------|-----------------------|---|
| Collision | Grounding | Collision with one or several ships |
| Grounding | Collision | Grounding due to the draw of the anchor or during the movement of a ship |
| Contact | Fire/explosion | Contact with fixed, floating, or flying objects |
| Fire Explosion | Fracture | Explosion or fire accidents |
| Hull Failure | Loss of control | Accidents due to fractures or defects in the body of a ship |
| Loss of Control | Equipment damage | Includes accidents, such as cargo, equipment, fuel, and other contents overturn in the sea, loss of control for ship movement (helm system), electricity loss, moving system loss |
| Ship/Equipment Damage | Capsize/Listing | Accidents that cause damage to ship structure or equipment |
| Capsize/Listing | Foundering | Accidents accompanied by capsizes |
| Flooding/Foundering | Ship missing | Accidents with flooding or foundering |
| Ship Missing | Occupational accident | Ship missing |
| Occupational Accident | | Body organ fracture, shock, burning with steam, slipping, falling, people falling into sea, violence, fight and similar cases |
| Others | | Cases other than the mentioned ones |
| Unknown | | Unclear |

industries as a major threat.

The importance of marine accident investigations is high and the IMO obligated the authorities of maritime issues in each country to perform investigations concerning the occurrence of accidents in the fleets under their flags and reflect the results to the IMO. These decisions have been taken according to the International Convention for the Safety of Life at Sea (SOLAS) regulation I/21 and the International Convention for the Prevention of Pollution from Ships (MARPOL) regulations 8 and 12.

As a result, the assessment of the risks and planning for prevention from marine accidents are among the important tasks of the Research and Development Unit of the ranking institutes. Development of a system for recording the reports of marine accidents and learning some lessons from these accidents are necessary for developing new rules or promoting and modifying the

existing rules. Overall, the common culture in the systems of maritime inspection is using the experiences from marine accidents to prevent from repeating (11). Seafaring is a high-risk occupation, and the safety aspects of working on board vessels are a major concern for maritime organizations and seafarers. In this regard, one of the main tasks of the marine commander is to ensure the safe navigation of the vessel. Despite continuous efforts in the construction of safe vessels and the use of advanced equipment including navigation and navigation assistance, numerous maritime accidents for various reasons, including manpower error and weakness in education systems, national and international laws and regulations and how they are implemented, still ongoing happen. (35).

Classification of Marine Accidents

Table 1 demonstrates the classification of

marine accidents according to the MSC-MEPC.3/Circ.4 directive (IMO) approved on 28 August 2013. Table (1) shows the classification of types of maritime accidents of the International Maritime Organization. (36).

Methods

This descriptive survey research with an applicable aim was performed on the statistical population. Considering the descriptive applicable nature of this study, data were collected through the library method in which all the published resources, including books, encyclopedias, journals, and newspapers are investigated. In the field method, the researcher used a researcher-made questionnaire in the field for collecting the data. In the present study, the validity of the survey was confirmed by the experts and the final questionnaire was delivered to the participants following a review of the literature and designing a primary questionnaire.

Moreover, the reliability of the survey was affirmed by Cronbach's alpha utilizing the SPSS software. To this aim, the designed questionnaires were completed by 30 individuals in a pilot study. The Cronbach's alpha was calculated for 12, 8, 5, 7, 9, 8, and 7 questions in the management, human error, training, inspection and monitoring, physical and environmental factors, information system, guidelines and technologies, and specialized equipment and support parts, respectively. Therefore, Cronbach's alpha was calculated for the same number of questions was 0.8631. SPSS software was used to analyze the data in this study, so that after extracting the questionnaire data, first descriptive methods including frequency, percentage, mean, standard deviation about the studied variables were used for demographic studies. Then, to answer the research questions, a sample of One-sample T-test and to show the importance of the questionnaire sections, Friedman test were used for the research questions.

All the data were analyzed using the SPSS software (Version 22). First, a demographic evaluation was performed by the descriptive methods, namely frequency, percentage, mean, standard deviation. Afterwards, the one-sample t-test was applied to answer the research questions and the Friedman test was utilized to indicate the importance of questionnaire parts and test the

research questions.

Findings

Demographic Description

The results of the demographic analysis demonstrated the highest frequency was for the age group of 31-40 years. In terms of experience, we observed that the highest frequency was for the age group of 6-10 years. In addition, the highest frequency of education level was found for the associate degree with 141 people. Regarding the employment location, 58 individuals were center staff and 176 people were operational.

Test of Research Questions

What are the most important factors effective in the crisis management of marine hazards in Makran coasts?

According to Table 2, the significance level was obtained as zero, which was smaller than the error level ($\alpha=0.05$). Consequently, considering a confidence level of 95%, we can conclude that the participants believed that the factors affect crisis management related to marine hazards in Makran coasts.

Priority of the Factors Effective in Marine Hazards

According to Table 3, the significance level was obtained as zero, which was smaller than the error level ($\alpha=0.05$). Consequently, considering a confidence level of 95%, we can conclude that the participants believed that management, human error, training, inspection and monitoring, physical and environmental factors, information systems, guidelines, and specialized equipment and technology affect crisis management related to marine hazards in Makran coasts. Questions one to eight of the research are confirmed at the significance level of 95%.

Ranking of the Priorities

The ranking was completed using the Friedman test.

H_0 : equality of the mean of ranks between the variables

H_1 : the difference of at least two variables concerning the mean of ranks

Therefore, the results of the Friedman test for ranking the priorities of the effective factors in crisis management are summarized in Table 5.

Tale 4 shows that the significance level is zero, which is lower than the acceptable error ($\alpha=0.05$).

As a result, the H_0 hypothesis could be rejected, which means that at least two variables exist the

Table 2. Tests results

| Variable | n | Mean | Standard deviation | T | Test value=3 Degree of freedom | Significance level | Result of hypothesis |
|---|-----|--------|--------------------|--------|-----------------------------------|--------------------|----------------------|
| Factors effective in the management of marine hazards | 234 | 3.7735 | 0.155 | 76.333 | 233 | 0 | Confirmed |

Table 3. Test results

| Variable | N | Mean | Standard deviation | t | Test value=3 Degree of freedom | Significance level | Result of hypothesis |
|--|-----|--------|--------------------|--------|-----------------------------------|--------------------|----------------------|
| Management | 234 | 4.041 | 0.25807 | 61.706 | 233 | 0 | Confirmed |
| Human error | 234 | 3.8333 | 0.35641 | 50.936 | 233 | 0 | Confirmed |
| Training | 234 | 4.1927 | 0.47152 | 51.192 | 233 | 0 | Confirmed |
| Inspection and monitoring | 234 | 3.5989 | 0.47152 | 19.43 | 233 | 0 | Confirmed |
| Physical and environmental factors | 234 | 3.0763 | 0.59845 | 3.688 | 233 | 0 | Confirmed |
| Information system | 234 | 3.4554 | 0.4096 | 16.997 | 233 | 0 | Confirmed |
| Guidelines | 234 | 4.3323 | 0.59845 | 34.054 | 233 | 0 | Confirmed |
| Specialized equipment end technologies and support | 234 | 3.6581 | 0.43835 | 22.966 | 233 | 0 | Confirmed |

Table 4. Friedman test

| n | Chi-square | Degree of freedom | Significance level |
|-----|------------|-------------------|--------------------|
| 234 | 902.022 | 7 | 0 |

Table 5. Friedman ranking

| Variable | Mean of ranks |
|--|---------------|
| Management | 5.85 |
| Human error | 4.79 |
| Training | 6.5 |
| Inspection and monitoring | 3.55 |
| Physical and environmental factors | 1.57 |
| Information system | 3.06 |
| Guidelines | 6.77 |
| Specialized equipment and technologies and support | 3.91 |

mean of which are different. Therefore, we can rank the factors effective in crisis management.

Table 5 indicates the mean rank for prioritizing the effective factors in crisis management. Considering the mean of ranks, guidelines, training, management, human error, specialized technologies and equipment, inspection and monitoring, information system, physical and environmental aspects with the mean ranks of 6.77, 6.5, 5.85, 4.79, 3.91, 3.55, 3.06, and 1.57 were ranked as first to eighth, respectively.

Discussion and Conclusion

The present study aimed to investigate and

prioritize the influential factors in crisis management related to marine hazards of Makran coasts. Results of data analysis revealed that diverse factors affect the crisis management of marine hazards in Makran coasts. Furthermore, we prioritized the effective factors, including management, human error, training, inspection and monitoring, physical and environmental factors, information systems, guidelines, and specialized technologies and equipment and support.

Findings of prioritizing the influential factors in the crisis management of marine hazards showed that guidelines, training, management,

human error, specialized equipment and technologies and support, inspection and monitoring, information system, and physical and environmental factors were ranked as first to eighth, respectively.

Overall, our findings revealed that suitable needs assessment and planning affects the execution of guidelines for dispatching vessels to sea. Another influential factor is supplementary and specialized marine training that improves the knowledge of managers concerning crisis management and motivates the employees leading to higher job satisfaction and enhanced abilities for confronting disasters.

Furthermore, the application of specialized intelligent technologies (marine simulators) in training centers and during work, inspection, and monitoring the execution of guidelines and the performance of managers, improving and training the management of simulated crises are all considered as factors affecting crisis management. Moreover, recruiting expert employees in the Maritime Rescue Coordination Center (MRCC) for on-time meteorology inquiries and early warnings to the functional vessels and guiding the vessels that have announced emergency conditions from the coast can be useful in preventing from accidents and success in the management of marine crises.

Considering the results of the current study, the following recommendations are proposed:

1. One of the tasks of the vessels of marine security is protecting marine borders and the safety of sailors in their protection area. Therefore, they play a fundamental role in the country's economy. Having a comprehensive plan for facing and controlling the consequences of accidents and managing marine crises and hazards is of importance in the development of marine shipping and transit. It is necessary to identify the locations with the possibility of crisis and natural disasters. In addition, it is needed that we use the capacities of the region and coordinate with other maritime organizations located in the region, compile a purposive plan, and execute common maneuvers for reducing and managing marine disasters.

2. Crisis management managers of marine hazards should be specialized, separate from the senior staff of marine organizations and should always be evaluated and the top managers should be honored.

3. Planning for common search and rescue practices in transnational level with neighboring countries and marine rescue agreement (compiling national marine rescue plan) for identifying equipment and benefit from experiences. Moreover, plans of crisis management by neighboring countries along with coordination and training concerning crisis management provided for the managers of maritime organizations and human forces at the time of disasters out of the control of the SAR system and the related maritime organizations of each country are needed. All these are important for confronting transnational crises in marine regions, such as the accident that happened for Sanchi in the China seawaters.

4. Various scenarios of marine hazards should be written and edited and common practices with related organizations should be held periodically. In addition to recording and training the personnel, the weak and strong points of each organization need to be identified in order to solve the observed problems and promote practical force leading to higher success in the upcoming maneuvers.

5. All the efforts for crisis management should be directed toward improving security culture.

6. Conducting studies and researches for benefitting from scientific, specialized, and experimental principles and achievements in different countries concerning crisis management and functionalizing some successful plans in the field of crisis management and marine hazards. Furthermore, the projects and researches of students and authors should be valued.

7. Developing diverse majors of marine crisis management and training expert managers in each field resulting in the promotion of specialized committees for crisis management.

8. Preparing guidelines for coordinating maritime organizations and responsible authorities to diminish the effects of accidents.

9. Supporting the three powers, ministries, and the armed forces of the region, especially the maritime army, people assemblies, Red Crescent, and the center of marine SAR at the highest possible level and equipping them with rescue vessels and modern marine aid equipment. Moreover, the SAR center should be equipped with intelligent technology and information systems regarding aid and rescue.

10. Following the occurrence of any marine accident, the first setting with which urgent contact is made is the closest marine SAR center of that region. This center is in charge of SAR, medical aid, prevention from marine pollution, and marine security control in a region. Consequently, the development of maritime SAR centers in Pasaabandar, Kalat, Pazm, and Beris centered on Chabahar results in the enhancement of marine shipping and international trade due to closeness to the navigation channel, accelerating SAR mission for transit ships, and improving safety in the waters of IRI.

11. Training concerning crisis management to sailors and captains along with signing an agreement by the marine SAR center of ports office. In addition, it is needed to prepare common scenarios and maneuvers based on the accidents recorded by the committees of accident investigation and to issue qualification certificates for learning marine rescue at the time of accidents.

12. All the marine accidents and hazards recorded by the experts of marine accidents should be distributed to experienced sailors and captains and university professors of marine crisis management as booklets and educational films with an analysis of how they happened and practical approaches for crisis management.

13. Consultation sessions with all groups, including the authorities of the Ports and Maritime Organization, Red Crescent, representatives of sailing lines, captains, and authorities of Sistan and Baluchestan and Hormozgan provinces. The importance of marine SAR subject and role of each organization should be accurately stated and the national marine SAR plan needs to be periodically compiled as distinct scenarios and the points of weakness and strength of each organization could be resolved.

14. Training the employees of professional marine majors and skills for surviving in the sea in specialized maritime centers through signing agreements with the maritime forces of the army, revolutionary guard, and Maritime University according to the educational standards.

15. Signing cooperation agreement with the Life Saving and Diving federation for training all the operational personnel on a vessel and forming a diving team for success in the marine SAR mission and preparing them for emergency cases.

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Conflict of Interests

There is no conflict of interest regarding the publication of this study.

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