UNIVERSITY OF PIRAEUS

DEPARTMENT OF MARITIME STUDIES

MSC IN SUSTAINABILITY AND QUALITY IN MARINE INDUSTRY

"HUMAN FACTOR: TOWARDS A UNIFIED APPROACH FOR SAFETY MANAGEMENT IN SHIPPING"

APOSTOLOS TSAMOURTZIS

MAY 2023

Declaration

I hereby declare that the work in this thesis with title "Human factor: Towards a unified approach for safety management in shipping" has been carried out by me and the dissertation was not formed to obtain any other degree or professional certification. In addition, I declare that I have properly acknowledged the work of others by providing specific references to the work.

This master's dissertation was approved by the three-member advisory committee appointed by the department of maritime studies of the University of Piraeus in accordance with the regulations of the postgraduate studies program. The members of the committee are as follows:

Advisory committee:

1. Prof. Ernestos Tzannatos (Supervisor)

2. Assoc. Prof. Georgios Daniil (Member)

3. Assist. Prof. Stefanos Chatzinikolaou (Member)

Contents

<u>Abstract</u>

Introduction – Shipping is a special commercial and economic system due to the nature and specificity of the entities involved, the specialized know-how required, and the very high capital involved. Shipping companies have complex organizational and management structures, operating as global organizations. For the proper operation of businesses, all available company resources must be properly managed.

Aim - The purpose of this thesis is to make an in-depth research about the "Human Factor", towards a unified approach for safety management in shipping. Secondly, through this study, an effort is made in order to interpret the results of the research, to present the conditions that shape them and to come up with proposals that will improve these conditions.

Methodology - The study makes use of both of secondary and primary research. Already published relevant and appropriate data have been carefully chosen. A wide range of related secondary sources, such as, magazines that present the "Human Factor", towards a unified approach for safety management in shipping, credible professional web sites, online newspapers and magazines, professional journals and blogs, and last but not least social media posts and statistics which are the main tool of this research, especially many posts and reviews were used to come up with the desirable result.

Results – The 37% of the participants said that they neither agree nor disagree with the fact that the lack of awareness of the seriousness of the jeopardies of the job from part of crew members is possible danger for incidents or accidents, the 34% totally disagreed whereas a 22% agreed, the 55% of the participants said that they agreed with the fact that work overload from crew members is possible danger for incidents or accidents, a 24% neither agree nor disagree and a 18% totally agreed and the 36% of the participants said that they agreed with the fact that decisions based on incomplete information from crew members is possible danger for incidents or accidents, a 33% totally agreed whereas a 27% neither agreed nor disagreed.

Conclusion – Consequently, shipping companies must ensure that Masters / First Engineers (old and new), Mates / Second Engineers, Second Mates / Third Engineers and all bridge / engine

watch officers (even deck mates / engine room), are well versed in new technologies on the bridge/engine room and are able to interact as best as possible with other officers, pilots and equipment on the bridge/engine room, both under normal conditions and in distress situations.

1st Chapter – Introduction

It is actually a fact that the human factors refer to environmental, organizational, technology, task design and human and individual characteristics, which influence behavior at work in a way which can affect health and safety. Human factor management is very challenging within a shipping company. Currently, the Tanker Management Self-Assessment (TMSA) 3 will publish a new element which will need to be adopted by shipping companies. This element is called "Human Factor".

In addition, the Ship Inspection Report programme (SIRE) has been upgraded in SIRE 2.0 and it will come in force within 2023, and the human factor, as long as the way a shipping company manages the human factor, will be a very crucial indicator for a successful inspection. Currently, we have several resources assisting us managing the human factor (procedures, policies, culture, equipment, systems etc.), but is these enough to manage the human factor?

The environment, state of mind, physical conditions, communication, soft skills etc. aren't they equally important? Have we got them seriously in consideration? Therefore, by developing this dissertation, it is very important to examine how the human factor can be integrated into the shipping companies' safety management systems.

Shipping is a special commercial and economic system due to the nature and specificity of the entities involved, the specialized know-how required, and the very high capital involved. Shipping companies have complex organizational and management structures, operating as global organizations. For the proper operation of businesses, all available company resources must be properly managed. According to Barney and Wright (1998), every firm is required to optimally combine three basic types of resources:

1. The physical, such as plant, equipment and corporate capital

2. The organizational - administrative, which include management procedures such as the implemented management systems, planning, control, the feedback processes

3. Human resources, which include skills, abilities, and eloquence and tacit knowledge, the experience of employees.

The successful combination of the above resources can ensure the optimization of the company's performance, the acquisition of a competitive advantage, and finally its sustainability. In this thesis, the management of the last category of available business resources, human resources, is analyzed, with the aim of understanding the way in which Human Resource Management is applied in the shipping industry. The human resources are perhaps the most important productive resource of the company, on whose performance depends the activation and utilization of all other factors of production. Specifically, for the environment of the ship, which is undoubtedly a peculiar space, in addition to its usual difficulties, it presents a series of adversities, which are rarely found in other professions, while it often hides dangers that the working seafarer must learn to face.

In addition, due to the globalization of shipping, the development of technology, the automation of systems, etc., the need has arisen for the acquisition of the most suitable workforce for the proper execution of tasks and responding to the difficult situations that prevail in its environment ship. The business function that deals with covering the above is Human Resources Management.

Over time, in the industry, there has been an attempt to give a name to the agency dealing with the handling of labor relations. Initially, the term "Personnel Services" was used, then the term "Industrial Relations" was adopted, while the term "Labor Relations" was often used. In practice, all three terms above are synonymous. Over time, the term "Personnel Management" was supported which, however, according to some authors, expresses a short-term approach to issues for the personnel of a company (Schuler, 2000).

During the recent years, the most widely used term is "Human Resources Management", through which an effort to deal with the personnel of a company over time is signaled, as for the first time this is characterized as a "resource". According to Jackson & Schuler (2000), "Human

resources or human resources are the sum total of talents and willingness to perform of all the people of a company who can contribute to the creation and completion of the mission, vision, strategy and goals of an organization".

Management of Human Resources or Human Resources Management is the function of a business or organization (generally an organization) that deals with the attraction, training, evaluation and reward of human resources, taking into account the labor relations, health, safety and justice and considering people as the most important factor in achieving the organization's goals.

Therefore, a tried and tested (and therefore commonly accepted) definition of Human Resource Management is the following (according to the British Institute of Personnel Management):

A) The total responsibilities of all those involved in People Management, but also the work of the specialized scientists dealing with this issue.

B) The Administration department, which deals exclusively with the company's human resources and the relationships between them in the working environment.

C) The overall effort to achieve efficiency and fairness within the workplace.

D) The overall effort to develop human resources to stimulate their contribution to the organization both as individuals and as members of the group to which they belong.

As a result, to the above, the Human Resource Management is a scientific branch of Business Administration. It studies and researches all issues related to the management of a company's human resources. Its purpose is to ensure at all times the right people in terms of

quality and quantity that the company needs, as well as their effective use and utilization. Human Resource Management is an important operational function, since people are the most important and critical success factor of any organized human activity. This function is now assigned to specialized executives with relevant studies and experience.

2nd Chapter - Literature Review

2.1 Definition and Characteristics of the Strategic Human Resource Management

The Strategic Human Resources Management is defined as the set of policies and methods of Human Resources Management that create the professional skills and behaviors required to achieve the company's strategic goals, as defined by the operational of strategy and are implemented through strategic management. Therefore, the Human Resource Management is considered strategic "when it involves all executives, when it values people as the most important and unique capital of the organization, when it operates proactively in human relations, and when it seeks to improve the performance of the business, the needs of workers and social welfare' (Poole, 1990).

2.1.1 The Role of the Strategic Human Resource Management

The Strategic Human Resources Management is necessary in a company due to its highly competitive environment (financial, commercial and technological). Human Resource Advantage (HRA) is based on two components:

A) Superiority in human capital, when a company has people with higher levels of knowledge, abilities, skills and experience than its competitors

B) Excellence in Human Process, when employee relationships and teamwork in solving problems make the company able to perform its functions faster, effectively and efficiently.

2.1.2 The Forms of Strategic Management

The role of strategic Human Resource Management can be:

- ✓ Executive, where the basic rule is that its policies and activities section of the CSI must go hand in hand with and support the general and competitive business strategies.

- ✓ Formative, where the company's strategies are formed in collaboration with the ATT department.

The process of aligning the strategies and actions of the Human Resources Department with the business strategy is as follows:

o   Defining the business strategy

o   Determining the workforce behavior required to produce the results that will help the business achieve their goals its strategic goals.

o   Defining Human Resource Management policies and actions that will lead in the desired behavior of the employees

o   Work with line managers to ensure implementation of action plans.

o   Development of methods for evaluating the performance of the action of the ATT.

2.2   The Shipping Market Characteristics

In shipping, and especially in the transport of bulk cargoes, the productive demand is what determines, at irregular intervals, the needs for manning ships for the purpose of transporting goods. This volatile factor makes shipping company owners behave conservatively in HRM matters, especially in terms of payroll, trying to keep manpower costs low in order to increase value (profit) (Progoulaki, 2008). The main characteristics of the Maritime Market are:

Unit cost reduction strategy: The increased competition between shipping companies, combined with the uncertainty that prevails in the productive demand, leads to the employment of a maritime workforce with low payroll costs. However, it turned out that due to the weakness and lack of initiative of the crew there was poor maintenance equipment and companies faced increased

11

maintenance and repair costs, which led to an indirect increase in costs.

Volatility and fluctuations due to the nature of shipping - Due to the nature of shipping there is a relative volatility, mainly related to the reductions and increases of the freight rates. Fare fluctuations are due to the relationship between supply and demand. In periods of high freight rates, shipping companies' revenues exceed the operating costs of their fleets, thus providing the opportunity to invest in Human Resource management.

Complexity in the division of labor – Geographical dispersion - Shipping companies employ human resources both on ships and on land. The hierarchical structure of the ships differs from that applied in the company's offices. The company can manage many different types of ships, but also in different locations, in a global geographical scope (geographic dispersion). It is therefore obvious that it is difficult to implement a single Human Resource Management system.

Standardization - In the shipping field, and especially in the ship environment, most of the procedures consist of standardized actions. The international regulations that impose them also contributed to this, with the aim of developing a safety culture in the companies' staff and crew members. However, it seems that everyone's safety culture business arises from the current regulations that impose it, making it difficult to create a competitive advantage.

Institutional framework – Choice of flag - The ship's flag defines a set of standards that must be followed by shipping companies. These standards mainly affect the national composition of the crew. Greek legislation provides for the crewing of Greek-flagged commercial ships with a certain minimum number of Greek sailors depending on the size of the ship, while the captain must be Greek. However, the adoption of flags of opportunity by some companies gives them the right to mismanage crews, thus undermining their credibility in Human Resource management.

Global nature of Maritime Labor Market – Cultural diversity - Every shipping company, regardless of where its headquarters is located, has the possibility to choose personnel from any country, thus creating on its ships a multicultural environment. Thus, the need for companies to create a human resource management system that accommodates and respects the differences of all crew members, and at the same time is able to overcome any problems that arise due to the difference in language, culture and general cultural differences. In the context of ships under the Greek flag, usually the "foreign" members occupy junior crew positions, while the locals cover the positions of Officers and Petty Officers. This multicultural environment also makes it difficult to implement a single Human Resources management system.

2.3   The Management of Human Resources in the Shipping Companies' Offices

2.3.1 Needs of a Shipping Company in Employees
The shipping company's personnel needs are largely determined by the following factors: (Theotokas, 2011)

✓   Fleet size. The relationship between the size (fleet) of the company and the number of personnel is influenced by the possibility of economies of scale.

✓   Fleet specialization and project management complexity

✓   Communication technology. Extent and intensity of use of new technologies.

✓   Objectives – Strategy. Low cost – quality, differentiation, responsiveness to customer requirements

✓   Management style and culture. Degree of control – authority, roles, task.

2.3.2 Management Work Groups in the Shipping Company
In shipping companies, there are three management task groups (Moreby, 1983):

✓ The group dealing with the formulation of business policy and strategy

✓ The group that deals with expenses, that is, with the support of the operation of ships and with their management from land (operation, technical, crews, supplies)

✓ The team that deals with the revenue of the business (charters, collection of fares, insurances) In order to cover the above jobs, which make up the administrative work groups, it is necessary to have competent personnel with experience related to the management of ships and the shipping industry in general.

Before analyzing the functions of the HRM, it would be appropriate to refer to the factors that push employees to effectively and efficiently perform the work assigned to them, trying to harmonize the company's goals with their own personal goals. Therefore, by the term push-motivation we mean the factors that motivate employees to perform the work as best as possible, with the main purpose of fulfilling their own personal goals. The push-motivation process is a determining factor that influences the behavior of individuals.

Motivation plays a very important role in the workplace, as the behavior of individuals is caused by their desire to reach a certain goal. When employees are motivated, they become more efficient in performing their work. Motivation is usually associated with the needs, wishes or desires of individuals. It is the internal motivation that acts as a cause, as a prompt or as an inspiration for action. Different people are motivated by different motives and the conditions of motivation vary. When there is an unsatisfied need, tension is created, which in turn acts as an impetus to adopt a particular behavior.

2.3.3 Motivating Factors

Frederick Herzberg, a business strategy consultant, studied work enrichment in relation to personal development. His theory aimed to understand the needs of workers but also the factors that make a job either pleasant or unpleasant for them. In his theory he uses the terms "motivation" and "health". Motivation refers to the factors that increase employee engagement, while the term "health" refers to the factors that, when not working, create a feeling of sadness, resulting in to reduce employee engagement and motivation. In the workplace, it is necessary to provide for the promotion of those factors that work in the direction of fulfilling the needs of human resources. The factors are divided into two categories:

✓ The hygiene and maintenance factors, which concern wages, employment conditions, the administration and insurance system, but also physical working conditions and hygiene in the working environment

✓ In the motivational factors, which concern the social and psychological needs, such as the recognition, the praise, the reward, the promotion and the manifestation of the full potential of the employees.

The employee motivation theories can be divided into three categories:

1. Theories of satisfaction of needs

2. Theories of procedures

3. Theories of rewards

The study of motivation theory is very important for understanding the differentiation of human needs, in terms of their importance in the push-motivation process, which is a determining factor of the individual's work behavior. In more detail the theories of motivation:

Theories of satisfaction of needs

Characteristic of these theories is the attempt to satisfy the basic needs of people. A representative example of needs satisfaction theory is Abraham Maslow's hierarchy of needs (1954). According to his theory, the needs of individuals are classified as follows:

✓ Biological needs for the acquisition of main consumer goods, which cover basic requirements and are directly linked to the survival of the population, such as food, clothing, shelter and others related.

✓ Security needs, which refer to the certainty and security sought by the employee, against a possible loss of his income. This category includes professional rehabilitation, permanency, social security, etc. Specifically, in the shipping industry, as far as seafarers are concerned, it is very common for them to choose to work in smaller, more "family" companies that provide them with the feeling of security, rather than the "bigger" and more famous shipping companies that usually provide better wages.

✓ Social needs, which are linked to the individual's social status and the individual's tendency to communicate and create relationships with his colleagues and his environment in general. Social needs include the need for appreciation, understanding, respect and acceptance by society in general. Also, an important factor for the selection of maritime work by the sailors, as well as the atmosphere on board and the relationships with colleagues is directly linked to the performance and efficiency of employees, especially in such a limited workspace.

✓ Self-esteem needs. Usually, after satisfying the above needs, the person seeks his recognition from the people in the workplace or the environment in general, gaining fame and prestige that make him accepted and recognized in society. The seafaring profession is generally considered as a profession that confers prestige on the workers, mainly on the people who hold a high position in the hierarchy and some "title" (e.g. Chief Petty Officer, Lieutenant Commander, Chief Officer, Captain). This need of sailors motivates them to work more efficiently to rise in the hierarchy.

✓ Self-fulfillment needs, which aim at the completeness of the individual and the fulfillment of his personal aspirations, according to his ideals, which can be material or immaterial and are usually subjective and express each individual. For sailors the personal pursuits can be either the acquisition of a certain amount of money, the acquisition of material goods or simply succeeding

in reaching the top of the hierarchical pyramid and obtaining the title of Master.

It is important to emphasize that the prioritization of needs may differ from person to person, depending on their personal desires, aspirations and ideals. According to Maslow, people prioritize basic needs and when these are met, they move on to the next.

Theories of processes

Characteristic of this theory is that motivation is considered the starting point of processes that lead individuals to specific behaviors. Representative is the theory of Victor Vroom (1964), the "theory of expectation". According to her, individuals are motivated by achieving a specific outcome. In this theory, it is not exactly described what motivates the employee, but the process, i.e. in what way it is motivated i the person. His theory was based on the following assumptions:

✓ Employees understand how their performance is linked to their extrinsic (raise, promotion, benefits) and intrinsic (prestige, recognition) rewards.

✓ Employees perceive to what extent they have the ability to achieve the target level of performance

✓ Employees recognize the value of the rewards offered by the company.

According to Vroom, the characteristics that influence the individual are the desire for rewards, the expectation of rewards, and the expectation of performance. Reward desirability is the measure of the employee's pursuit of certain rewards (desire intensity), reward expectancy refers to the likelihood that the individual will obtain the desired rewards by having a certain level of performance, while performance expectancy is related to the probability that the worker calculates to have a certain level of performance, after first exerting a certain amount of effort.

Theories of rewards

This theory is about rewarding or punishing employees and the impact they have on their work behavior. The purpose of a reward is to encourage a particular behavior of the individual, with the expectation that it will continue to occur. Reward is usually done with additional benefits to employees, which can be financial or non-financial, individual or group and are used as motivation, reward, accountability and commitment for employees. When a behavior is rewarded it tends to become permanent. For sailors, the rewards can be the recognition of their work by

their superiors, their preference and re-hiring by the company and in some cases the collection of monetary remuneration (bonus).

Punishment is usually imposed when an undesirable or acceptable behavior of the individual is repeated, after the necessary recommendations have been made. The punishment is carried out by imposing penalties. In the ship's environment, the writing of a negative evaluation by the Master or the head of the navy or even his dismissal before the completion of his contract is considered as a method of punishment. In the event that the seafarer repeats the unacceptable behavior on the next ship he will work on, he risks not being rehired by the specific shipping company. Rewards are given continuously or at periodic intervals, after the necessary control has been carried out by the supervisor. For fees granted at periodic intervals it has been observed that:

✓ In the event that there is a fixed schedule for their appraisal, subordinates intensify their work efforts some time before the appraisal to show a good image to the appraisers.

✓ In the event that the evaluation schedule is variable, incumbents are more efficient since they do not know the exact time when the evaluation will take place.

✓ In the event that rewards are given according to the efficiency that each one has; subordinates know in advance that the amount of remuneration they will receive will be proportional to their performance.

Especially in the ship environment, due to the particularity of the maritime profession, push and motivation is very important for employees. Usually due to the difficulties the seafarers face, they cease to be efficient and perform their duties properly, which often leads to accidents. In addition, a large proportion of Merchant Marine Academies students who decide to pursue the profession, after completing their first or second business trip leave the school and the profession. The same is true of older seafarers who have been in the profession for years. Therefore, having a proper employee motivation system is essential for shipping companies to retain their staff.

The motivating factors for seafarers are usually financial in the early years of the profession, but over time their demands increase as they want to feel that their value is recognized. From this we conclude that the "Theory of satisfaction of needs" is mainly applied in the field of shipping. Other factors that motivate seafarers beyond their pay are extra rewards (bonus), additional company benefits both on board (internet, good working conditions) and

outside it (health benefits and insurance), as well as and the appreciation from the company towards the navy, showing their desire to re-employ the navy, but also investing in its training and development.

2.4   The Phenomenon of the Culture and Multiculturality in Shipping

There are hundreds of definitions for the concept "Culture". According to one approach, "*Culture is the collective programming of the mind that distinguishes members of one human group from another... culture in this sense includes value systems, and values are among the cornerstones of culture*" (Mead, 1998). Consequently, corporate culture can be approached as a set of shared beliefs, values and behaviors that support, in community settings, the exercise of entrepreneurial behavior within a firm (Gibb, 1987). The values that govern each culture are also those that shape its character and orientation.

Culture is a unique element for a business because it is what makes it stand out from the rest. It is the set of beliefs and values, commonly accepted by everyone, and shows the way all staff at all levels of the management hierarchy should behave. Culture makes company members feel like they know who they are, what they do, and why they exist. Therefore, it is the main orientation of the business (Georgopoulos, 2010). Researchers argue that there are seven dimensions that collectively shape the company's culture, these are (Georgopoulos, 2010):

1. Innovation and risk taking

2. Attention to detail

3. Orientation to the result

4. Human orientation

5. Orientation to teamwork

6. Aggressiveness

7. Stability

Culture plays a very important role in strategic management, because strategy and culture should go hand in hand, otherwise their non-alignment is likely to lead to failure. In addition, if there is not a common and strong culture that governs values and beliefs, it is very likely that

conflicts and poor cooperation will arise between employees. Shaping the culture within a company is not an easy task, it takes time and can easily affect the strategy it follows as well as the general implementation of a new strategic plan. According to Schein (1989), culture consists of the unconscious, facts, beliefs, assumptions, thoughts and feelings and constitutes the basis of the success of a business. He distinguishes three levels in corporate culture:

1. The findings (artifacts). They are the visible and auditory elements that indicate the perceptions regarding the culture. It can be the ways of behaving, the physical environment, the way of dressing, the stories and myths.

2. Shared values. They are adopted reasons why things are done in a certain way in the company, such as rules, codes of ethics, corporate statements, etc.

3. The basic assumptions. They are much more difficult to define and examine. They include the invisible but identifiable reasons why members of a group perceive, think, and feel a certain way about the external environment and the operation of the business. The mission of the business, how to solve problems, interpersonal relationships, time and space are some of the basic assumptions. One can better distinguish them either as ways of behaving not accepted by the company, or, on the contrary, as desirable ways of behaving.

Schein believes that it is very important for business leadership to place more emphasis on the third element, namely the basic assumptions. Findings can be overridden, new values can be introduced, e.g. by changing the company's mission or code of conduct. However, the culture of the company cannot be changed if its basic assumptions are not affected.

2.4.1 Shaping a Safety Culture

As was mentioned, each company has its own Business Culture, which is also embraced by the people who make up their workforce. In recent years, a new culture oriented towards safety levels has been established in the maritime sector in the maritime community. The purpose of safety culture is to reduce accidents, damage, personal injury and loss of time due to minor incidents, and to ensure safer ships and cleaner seas. Shipowners and managers must follow a set of regulations, standards and regulations set by the relevant bodies and implement safe practices in the operation of the ship, provide a safe working environment, establish some safety measures against all identified hazards and continuously improve the safe management skills of both crews and shore personnel, including emergency preparedness.

The Maritime Safety Committee of the IMO, in the annex of document 77/17 of 2003, gives the exact definition of the Safety Culture in shipping:

"*Safety Culture can be defined as a culture in which there is a significant awareness effort to reduce risks to persons, ships and the marine environment to as low a level as is reasonably practicable. More specifically, for an organization that strives to achieve such a goal, economic and social benefits will be imminent as a strong balance between security and commerce is maintained.*"

2.4.2 The Aspects of the Safety Culture

At the same time, in the same document, the ten key elements for achieving this culture are defined:

1. Management commitment to the goal of establishing a safety culture

2. Communicating the values of such a culture

3. Understanding productivity vs. security

4. Learning organization

5. Continuous provision of security resources

6. Participation

7. Common perceptions of security

8. Trust

9. Labor relations and job satisfaction 10. Education

2.4.3 The Application of the Safety Culture Model

The cultural or behavioral approach to improving safety is most effective when the technical and systemic aspects of safety are adequate, and the majority of accidents are due to behavioral or cultural factors. Therefore, the Safety Culture model is only relevant for organizations that meet certain criteria. These criteria include:

- ✓ An effective Safety Management System (SMS).

- ✓ The assumption that the majority of accidents are not due to technical failures.

- ✓ The company has complied with Health and Safety legislation.

- ✓ The pursuit of safety is not due to the avoidance of persecution, but to desire accident prevention.

- ✓ Companies that do not meet the above criteria would be better off using their resources paying more attention to technical and systems issues.

2.4.4 The Stages of Developing a Safety Culture

There are five stages that a company must go through until it reaches its goal of developing a Safety Culture. It is preferable for organizations to progress sequentially through the five levels, building on the strengths and removing the weaknesses of the previous level. Therefore, it is not advisable for an organization to try to jump or skip a level. For example, it is important for organizations to move through the management level before the participation level, as it is important that managers develop their commitment to safety and understand the need to involve existing employees. The stages of developing a Safety Culture are as follows:

1.   Emerging: in the first stage security is limited to compliance with regulations and does not appear to be a key risk to the business and the primary responsibility for security rests with the security department. Many accidents are considered inevitable and part of the job and staff are not particularly interested in safety issues.

2.   Managing: The usual accident rate of the organization is average for the industrial sector to which it belongs, but at this stage this rate shows a tendency for more serious accidents to occur than the average. Safety begins to be considered a business risk and efforts are made to prevent accidents. Safety is limited to following rules and procedures and engineering controls and accidents are considered avoidable. Managers realize that the majority of accidents are due solely to the unsafe behavior of front-line staff, and the safety performance of workers begins to

be evaluated.

3.   <u>Involving</u>: At this stage, accident rates are relatively low, but the limit has been reached. The organization believes that employee involvement in health and safety is essential. Managers recognize that a wide range of factors that cause accidents are due to management decisions. A significant percentage of workers are willing to work with management to improve health and safety. The majority of staff accept personal responsibility for their health and safety. Safety performance is actively monitored, and data is used effectively.

4.   <u>Cooperating</u>: At this stage the importance of health and safety is recognized by the majority of staff and a division is made responsibilities, while each member acknowledges his personal responsibility for his safety. The organization makes significant efforts, taking measures to prevent accidents. Safety performance is actively monitored using all available data. Accidents outside the workforce are also monitored and a healthy lifestyle is promoted.

5.   <u>Continuous improvement</u>: The prevention of all employee injuries is a core value of the company. The organization has had a solid period without accidents or major incidents, but there is no sense of complacency. Performance monitoring is ongoing, while the organization strives for continuous improvement and promotion of health and safety. The shipping sector is a heavy industry with a particularly dynamic environment and many volatile factors. For this reason, the necessity is not found in the existence of a simple Safety Culture, but a Maritime Safety Culture. The companies adopt a "No Blame" policy, i.e. a policy of exempting the workforce from blame and accepting their human tendency to make mistakes, in order to encourage staff to communicate immediately, without the fear that if they report any problems or incidents they will be considered unfit for the position there. Seafarers are not blamed for 'honest errors' but are held accountable for willful violations and gross negligence.

Safety Culture is a safety policy that fosters a change in mindset and not just a change in safety systems. Safety behavior and Culture are directly linked to each other. Specifically, culture is the main determinant of employee behavior, while Safety Culture is a prerequisite for implementing the behavioral approach. After all, the work environment has a leading role in shaping the behavior of employees.

Finally, the companies also adopt a "Just Culture" policy. An atmosphere of trust in which people are encouraged, even rewarded, for providing essential safety related information, but in which they are also clear about where the line must be drawn between acceptable and

unacceptable behavior. A culture where those involved in an incident feel that they can cooperate fully with an investigation is "Just Culture".

2.4.5 Crew Multiculturalism

The global seafaring market consists of seafarers of various specialties, abilities and nationalities, and the role of employment agencies and external partners is crucial in its operation. Developing countries provide a large part of this labor force that moves to different parts of the world to find employment, and that travels around the world performing their work.

Greek-owned ships, and especially those in commercial shipping, are manned with multinational and foreign crews. Since the late 1980s (Thanopoulou, 1994), there has been a tendency to prefer foreign seamen, who are a more flexible and cheaper productive factor in the shipping industry, thus reducing the employment rate of Greek seamen. In a research conducted by the University of the Aegean (2006), it appears that the substitution of Greeks by foreigners has begun to consolidate at the officer levels as well.

The Greek sailors as well as Greek-owned shipping companies report that they prefer to work with Filipinos, due to the compatibility of the culture, while the problems they pointed out were related to the level of education and skills of the Filipinos. (Progoulaki, 2003, Theotokas and Progoulaki, 2004). Cultural diversity can enhance receptivity to new ideas, and contribute to creativity, innovation, increasing alternatives, but also speed and flexibility in responding to environmental changes and, in the long run, competitiveness. Another advantage of businesses that are culturally diverse is that they have the ability to attract the most talented and aware employees, who can increase the efficiency of mixed cultural teams.

However, cultural diversity can activate negative forces, such as ethnocentrism, stereotyping, and cultural clashes (White, 1999). Also, there can be dysfunction of work groups in problem solving, lack of team cohesion and morale. Among the most common disadvantages that multicultural groups and organizations experience is the difficulty in communicating due to different languages, the different interpretations that different cultures give to words and expressions, but also the different beliefs, values, habits and behaviors. Miscommunication between employees makes decision-making difficult and can lead to delays, errors, ambiguity and confusion.

23

2.4.6 Culture and Management of Cultural Diversity

Based on the above, one understands that people's behavior and perceptions are directly linked to the cultural and wider environment in which they are integrated. When people join the workforce of a company, they retain elements of their culture while being influenced by the corporate culture. In companies with a strong multicultural element, intercultural management constitutes the relationships and interactions that develop between cultures, the business and management.

Cultural diversity is a term used to denote the presence of different groups of people with different race, value and belief systems, religion, languages, etc., in a geographical area (Osman, 1999). The ability to manage cultural diversity refers to the ability (of a person or organization) to respect and understand, communicate effectively and cooperate with people who have different cultural backgrounds (Garcia, 1995). Successful management of the cultural diversity of human resources can lead to innovative business practices, faster and better learning within an organization, and sustainable sources of competitive advantage (Hoecklin, 1996).

In an organization with employees from different cultures, conflict of opinions is to be expected. Conflict between cultural groups is in itself a threat to success, for this reason it is necessary for a business to manage cultural differences in order to limit the risk and neutralize this threat. Appropriate management and control can ensure that conflict can increase the creativity and efficiency of mixed teams.

2.5   The Human Factor in the Sea Transport

The safety of human life at sea, the marine environment and over 80% of world trade rely on the professionalism and competence of seafarers (IMO, International Maritime Organization). This phrase alone sums up the fundamental role of the human factor in maritime transport. The importance shown by the IMO to the human factor was manifested in practice from 1978 with the establishment of the STCW (International Convention on Standards of Training, Certification and Watchkeeping for Seafarers) which was the first international convention to define criteria for training, certification and the control of all who manned the ships. In 1997, the IMO set out its vision, principles and objectives towards which it assessed that maritime transport should move in relation to the issue of the human factor (Lehr 2018).

The human factor is a complex and multidimensional issue that affects safety at sea and

the protection of the marine environment. It includes the whole range of human activities: the crews on the ships, the management and administration from the land, the recognized organizations, the shipyards, in general, that is, everything that contributes to the settlement of the issues that have to do with the human element.

The arrangements set by the IMO must respect the views of those directly concerned, i.e. the people on board the ships. Effective corrective actions after maritime accidents require a correct understanding of the involvement of the human factor. This is only accomplished by thorough investigation and systematic analysis of accidents to identify the contributors and the chain of events that led to them. During the development process of the regulations, safeguards must be put in place to prevent an accident from "a simple personal mistake" (Lehr 2018).

2.6   The Human Errors in Shipping Industry

As mentioned, the human errors are percentage-wise the biggest factor in causing accidents. To address this issue, always with the aim of increasing human reliability in order to significantly reduce the number of serious accidents in the Maritime sector, the reasons that lead a person to make wrong choices resulting in the possible occurrence of an accident should be extensively analyzed.

At this point it should be noted that the main categories of causes that lead the human factor to wrong choices are three: organizational and administrative issues (which include safety training, the creation of a safety climate and the creation of a culture aimed at safety), personnel issues (such as the level of training and awareness of the crew, the level of stress and fatigue at work, the ability to make good decisions, the level of working conditions and the level of awareness of situations that may arise) and finally issues concerning the design and technological level of the ships (automations).

The shipping companies in recent decades have been investing capital to improve the technological equipment of ships. These technological improvements include automation, so that the system depends less and less on the human factor (Hetherington 2006). The reason is obvious, as the automation increases on a ship, the actions that the human factor must perform are reduced, with the result that the chances of accidents being caused by wrong choices of the crew members are reduced.

However, increasing the level of automation can also have side effects. The crew

members taking it for granted that these machines have taken over part of the governance of the ship, do not concern themselves with the question of crossing the data, resting on the fact that the machines do not make mistakes. As a result, in case of incorrect operation of the automations there is no automatic crossing and correction by the crew, with the chances of causing a serious maritime accident increasing steeply (ibid 2006).

A typical example is the case of the ship "Royal Majesty" in which, during its course in Bermuda, a problem occurred in one of its antennas, as a result of which the ship's position was shown incorrectly on the screens. Although there were mechanisms by which the crew could have carried out preventive checks on this issue, this was not done, resulting in the misalignment causing the ship to run aground, injuring approximately a thousand people on board and costing the owning company seven million in lost revenue (ibid 2006).

At this point, most of the causes that lead to wrong decisions by the crew of a ship will be analyzed. And this is because both the working conditions and the living conditions on ships are very difficult despite the significant improvements that have taken place in this field in recent decades. So, the main causes of wrong decisions are the following:

Fatigue: It contributes significantly to the reduction of the produced performance crew as well as the significant burden on his health. She is responsible for some of the most catastrophic accidents in history. Characteristic can be mentioned the example of the Exxon Valdez grounding in 1989, as according to the data provided 24 hours before the accident the shift manager had only slept five to six hours, with the result that there is a strong possibility that his fatigue played a significant role in causing the accident (Hetherington 2006).

✓ Another typical example is that of the Peacock ship in 1996, which crashed into Australia's Great Barrier Reef, as the officer in charge of the bridge fell asleep fifteen minutes before the collision (Lehr 2018).

✓ The cure crews are aggravated by the ever-increasing demands, their shorter stops for refueling and cargo unloading, the reduction of sea passages and the increase of ship movements in international territorial waters (Hetherington 2006).

✓ Typically, an oil tanker with a capacity of 300,000 tons takes about 44 hours to unload, during which time the chief officer remains awake. In addition, shifts on the ship's deck and bridge are usually over twelve hours with five- or six-hour rest breaks between shifts. In general, the

main reasons for fatigue of crews are:

➢ Fragmented (and therefore poorer quality) sleep

➢ The obligation to sleep the crew at inappropriate hours

➢ The short breaks for rest

➢ Poor sleep quality due to environmental conditions

➢ Increased workload

➢ Additional stress for those working as deckhands mainly on night shifts.

All the above reasons contribute to the exhaustion of the crew, a result that mathematically leads to wrong moves and decisions. At this point it should be noted that although the IMO has established strict regulations regarding working hours and the need for rest, these are usually violated as companies push for better, more economical and shorter results, while many of the crew members do not know labor legislation (Lehr, 2018), are the following:

The level of stress: It is a factor that affects the health and productivity of an employee, which in turn damages the business itself. It is a fact that in a survey carried out by the Australian Maritime Safety Agency (AMSA), in a sample of 1806 participants (a sample that included both seafarers and other workers), seafarers in the majority stated that they experienced very high levels of stress during execution of their duties in relation to the rest of the workers who declared it in much smaller percentages (Hetherington 2006: 404-405).

Health issues: According to research carried out by the Australian Maritime Safety Agency (AMSA), seafarers presented many health problems, as they could not successfully complete simple fatigue tests, while in large percentages (32% and 24%) they exceeded the permitted rates of alcohol consumption and smoking respectively. To the above must be included the fact that research has shown that the maintenance of an employee's health level and safety have a positive proportional relationship (ibid 2006).

Non-technical skills: A competent crew member should not only possess technical knowledge, but also a range of skills such as good communication with their colleagues, the ability to be part of a team effort where needed, have an awareness of the environment and situations, while talking about an officer in the previous abilities, the leadership abilities should also be completed (ibid

2006). If he does not possess these skills, he is very likely to be a problem in the overall proper functioning of the crew. Breaking down these non-technical skills further we have:

❖ Perceptiveness of situations: this ability is related to the ability of the individual to correctly perceive what is happening in his environment at any time and at the same time to be able to predict the development of any incident (Hetherington 2006: 405-406). It usually involves three stages:

❖ In the first stage, the person should have the correct perception of the data of the situation, as a result of which he can form a correct picture

❖ The second stage involves combining, interpreting and storing the existing data to get a correct picture of the situation

❖ The third stage is about projecting the solution and is the most important part of the process, as this is what helps to resolve serious issues that may arise. From the research that has been carried out, it has been shown that approximately 71% of marine accidents are directly related to the lack of situational awareness (ibid 2006).

The issue of communication: Poor communication between members of a crew or even crew with excellent partners can lead to very serious accidents. A typical example is that of the deck officers' communication with the navigators. In all international ports due to heavy traffic require vessels over one size to enter them via navigator to prevent collisions or groundings. The role of the navigator is to guide the ship to a safe mooring and give orders to the ship's master to achieve it. Despite this, there has been a phenomenon of miscommunication between the two parties, mainly due to questioning of orders by the bridge officers, resulting in accidents (Hetherington 2006). If communication issues within the bridge staff are taken into account (there are cases of mistakes where while the second had realized that the skipper following the course he had taken would lead the ship to run aground or even collide, he did not do anything to warn him) and the ships with the respective VTS, then we can derive the magnitude of the problems that may arise due to poor communication (Harrald, 1998).

Linguistic diversity: On a ship today, it is very likely that its crew consists of people of different nationalities, who usually have English as their common secondary language, without this of course meaning that they have a good level of knowledge. This automatically means that there are often issues of communication between crew members, while it is not at all certain to achieve

successful communication in critical situations, where it is not certain that someone will be able to correctly express their position in their second language. Research has shown that the difficulty of getting along was a persistent problem among crews made up of people of different ethnicities (ibid 2006: 406-407). Due to these difficulties, misinterpretations and misunderstandings often occur, which can cause from small mistakes to large-scale accidents with catastrophic consequences.

Teamwork: The majority of skippers strongly support that good crew-member cooperation and teamwork are as essential on a ship as professional expertise. And this is because without the good cooperation of all crew members there is a great risk of making mistakes.

Organization issues - Observing all the above causes of errors that are due to non-technical factors, in the last period of time in the shipping industry various educational techniques have been developed which have as their purpose the improvement of the non-technical abilities of the ships' crews. The most basic of these is CRM (Crew Resource Management), which includes training in topics such as teamwork, communication, perceptiveness and decision-making, with the aim of improving crews. At the present time the training in question is mandatory in the United Kingdom with many other countries intending to follow its example, while many shipping companies now include it in their mandatory training programs as well, with the aim of reducing maritime accidents related for these reasons (Hetherington, 2006). Respectively training programs are ERM (Engine Room Resource Management) and BPM (Bridge Resource Management), which aim to train bridge and engine crews.

2.7   Chances to Reduce the Human Errors in Shipping Industry

From the analysis of the previous paragraphs, the fact emerges that the human error chapter is a complex situation as their possible causes are varied and numerous. The question can therefore reasonably be raised as to whether it is possible to reduce sufficiently (if not minimize) the errors made by the human factor. The truth is that this is a very difficult undertaking for many reasons. The main ones are the following:

Short memory: Due to the improvements that have been made in recent years in the technological, engineering and design sector, which has resulted in a noticeable reduction in maritime accidents, crews and ship owners have become restive, resulting in them being negligent in their duties in terms of it is about security (Kristiansen, 2013)

Participants focus on the consequences: People usually focus on the consequences of a marine accident rather than the causes, thus not actually solving the problem. For example, in dealing with accidents involving oil spills at sea, measures were taken to prevent or deal with the spill, such as building double-hull ships and in the purchase of anti-pollution and clean-up equipment, thus dealing with the consequences of such an accident. In fact, many times it becomes costlier to deal with the consequences than to deal with the causes (ibid, 2013)

The complexity of the issue: Security concerns both the technological and the human and organizational factors. Thus, it becomes very difficult to find all combinations of economically beneficial solutions that could further reduce accidents, due to the numerous interactions between the three factors. In addition, companies will much more easily make moves to improve the other two areas and not the human one, as they probably believe that there their investments will definitely pay off, especially in relation to the human factor where the results will be dubious. As it turns out, it is much easier and less expensive to technologically upgrade one's ships than to change the way people think (ibid 2013).

Inability to accept changes: People tend to avoid changes, even if it is the critical issue of security. So even if in theory they agree that some changes are necessary, in practice they often try to sabotage them in every way and means (ibid 2013).

Nevertheless, efforts to further reduce accidents should continue, possibly by modifying the study center (rather than the effects being the causes) and trying to make everyone involved understand the immediate need for change.

From the analysis carried out in the previous paragraph, it can now be understood why the human factor is the main factor responsible for causing accidents in the shipping sector. As we have seen, the causes of errors on the part of people are numerous and often of a completely different nature per category. This alone makes their complete treatment almost impossible. And on the one hand it makes sense as man is a multidimensional being. What is also readily apparent is that it is up to the shipowners to improve both the safety and living conditions, as well as to improve the level of training of the crews in both technical and non-technical knowledge, so as to make it possible in this way reduction of errors made. Another conclusion that emerges is that human reliability is an extremely difficult variable to quantify. And this is because the factors that push a person to make a mistake are too many. However, the quantification of human reliability is a necessary condition for its improvement, as only in this way can there be measurable results

from the implementation of measures aimed at preventing human errors.

3. Chapter 3rd – Methodology Research

3.1 The Aim of the Research

The purpose of this thesis is to make an in-depth research about the "Human Factor", towards a unified approach for safety management in shipping. Secondly, through this study, an effort is made in order to interpret the results of the research, to present the conditions that shape them and to come up with proposals that will improve these conditions.

3.2 Methodology Research

The methodology type, which is used for the conduction and writing of the specific dissertation, is concerned to the qualitative as also the quantitative analysis about the "Human Factor", towards a unified approach for safety management in shipping. According to a different approach, the qualitative research is research that emphasizes and focuses on meaning rather than human behavior. Qualitative researchers, according to Willing (2001), are interested in meaning, in the way people experience events. However, there are qualitative approaches that focus on the description of behavior (McLeod, 2001). There are also quantitative studies that do not focus so much on behavior as on some internal structures (McLeod, 1997).

In advance, a different approach mentions that a feature of qualitative research is the rejection of the natural sciences as a research model (McLeod, 2001). In contrast to the positivist science model based on the natural sciences, proponents of qualitative research focus on the study of the socio-historical and cultural context. Proponents of qualitative research attempt to explore the social world in the light of the experience of the subjects participating in this research. Qualitative research is naturalistic, contextual, situated, interpretive (Mishler, 1987).

It should also be mentioned that the qualitative research is considered -emic (emic) and idiosyncratic, in contrast to quantitative research, which is considered -ethical (etic) and legislative. Qualitative research is considered *-emic*, i.e. it focuses on the analysis of a culture based on some internal criteria, emphasizing its uniqueness, while quantitative research is considered *–ethic* in the comparative study of many cultures based on some universal, universal criteria. The *-emic* approach is based on the adoption of an internal approach to behavior within

a system. The *-ethical* approach expresses the study of the behavior of a system, as presented to an observer outside the system and uses criteria external to it (Mishler, 1987).

3.3   Research Design

The specific dissertation makes use of the secondary (qualitative) as also primary (quantitative) research upon use of questionnaires, specifically constructed for the particular dissertation. The information has been retrieved in a systematic way from credible and recent sources, which follows the academic needs and rules about the "Human Factor", towards a unified approach for safety management in shipping. This thesis has been designed in a way that follows the three objectives with the goal to answer to the research question. Thus, the research philosophy is the pragmatism by using methods that advances researches in the best possible manner. Studies from a wide variety of scientists and organization will be monitoring, analyzed, and presented while conclusions will be made.

3.4   Methodology Procedure

The study makes use of both of secondary and primary research. Already published relevant and appropriate data have been carefully chosen. A wide range of related secondary sources, such as, magazines that present the "Human Factor", towards a unified approach for safety management in shipping, credible professional web sites, online newspapers and magazines, professional journals and blogs, and last but not least social media posts and statistics which are the main tool of this research, especially many posts and reviews were used to come up with the desirable result.

3.5   Research Tool

The research tool used in the research to gather the necessary information is the structured questionnaire. It is a data collection tool preferred by researchers, as it ensures the rapid collection of many answers in a short period of time through questions with a uniform structure. It is characterized by low cost, takes the opinion of many and different respondents,

collects many different data, ensures the free and anonymous expression of respondents and allows the acquisition of data for features that are difficult to observe (e.g. opinions, emotions). At the same time, the use of the questionnaire as a means of data collection limits in-depth information and the receipt of details. The accuracy of the answers, their honesty and their subjectivity are not checked. The answers to the questions are processed and transferred to special systems for analysis. They are first classified and then coded. A questionnaire consisting of closed-ended questions was prepared for the needs of the present study.

3.6   The Sample of the Research

The sample consists of 100 participants who the majority of the participants (51%) were over 46 years old, the 40% were from 36-45 years old and the rest 9% were from 18-35 years old, the 82% of the participants were married, the 12% were divorced and the rest 6% were single and the 61% of the participants were university graduates, the 21% high school graduates and the rest 18% had a Master. Finally, the 39% of the participants had from 6-10 years of experience in Shipping, the 37% had over 16 years of experience, the 15% 11-15 years and the rest 9% from 1-5 years.

4th Chapter – Results Analysis

4.1 Analysis of questionnaire about the "Human Factor", towards a unified approach for safety management in shipping

Question 1

The 81% of the participants consider Safety Management in Shipping important and the 10% moderately important.

1.How important do you consider Safety Management in Shipping?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Moderately important	10	10,0	10,0	10,0
	Important	81	81,0	81,0	91,0
	Extremely important	9	9,0	9,0	100,0
	Total	100	100,0	100,0	

1.How important do you consider Safety Management in Shipping?
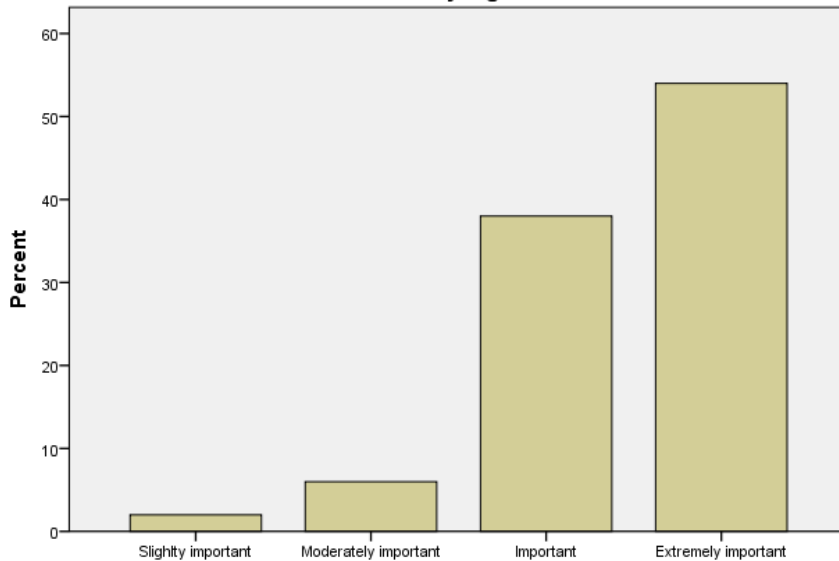
Question 2

The 54% of the participants said that the Shipping company they work for, consider extremely important that the employees/crew have read the safety regulations and the 38% consider it important as well.

2.In the shipping company you work for, how important it is for them that you have read the safety regulations?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Slighlty important	2	2,0	2,0	2,0
	Moderately important	6	6,0	6,0	8,0
	Important	38	38,0	38,0	46,0

	Extremely important	54	54,0	54,0	100,0
	Total	100	100,0	100,0	

2.In the shipping company you work for, how important it is for them that you have read the safety regulations?

2.In the shipping company you work for, how important it is for them that you have read the safety regulations?
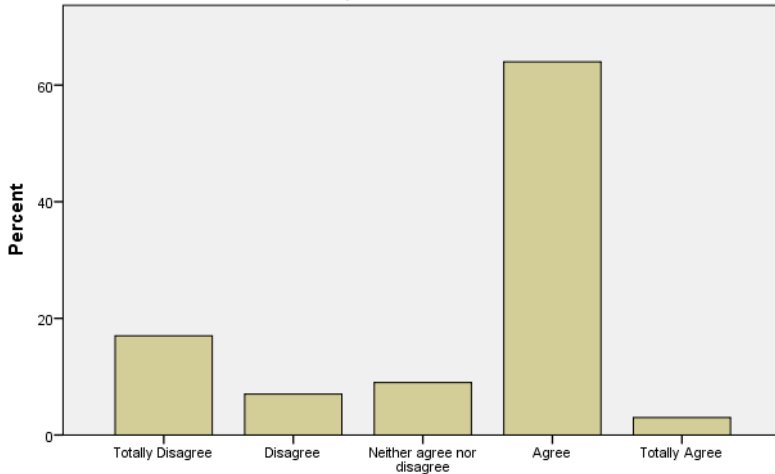
Question 3

The 64% of the participants said that they agree with the statement that "the crew spends more time filling out forms & less time actually focusing on the safety elements of their position" whereas a 17% totally disagree.

3.Do you agree/disagree with the statement that "the crew spends more time filling out forms & less time actually focusing on the safety elements of their position"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Totally Disagree	17	17,0	17,0	17,0
	Disagree	7	7,0	7,0	24,0
	Neither agree nor disagree	9	9,0	9,0	33,0

37

Agree	64	64,0	64,0	97,0
Totally Agree	3	3,0	3,0	100,0
Total	100	100,0	100,0	

3.Do you agree/disagree with the statement that "the crew spends more time filling out forms & less time actually focusing on the safety elements of their position"

3.Do you agree/disagree with the statement that "the crew spends more time filling out forms & less time actually focusing on the safety elements of their position"
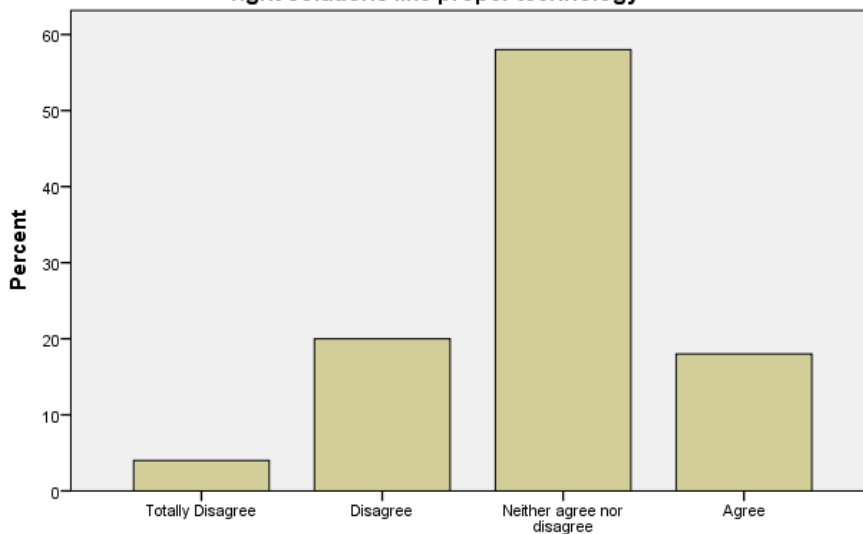
Question 4

The 58% of the participants said that they neither agree nor disagree with the statement that in order to meaningfully reduce incidents & accidents, the industry must be bold and be ready to invest in the right solutions like proper technology, whereas a 20% disagree and an 18% agreed with the above statement.

4.Do you agree/disagree with the statement that in order to meaningfully reduce incidents & accidents, the industry must be bold and be ready to invest in the right solutions like proper technology

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Totally Disagree	4	4,0	4,0	4,0
	Disagree	20	20,0	20,0	24,0
	Neither agree nor disagree	58	58,0	58,0	82,0
	Agree	18	18,0	18,0	100,0
	Total	100	100,0	100,0	

4.Do you agree/disagree with the statement that in order to meaningfully reduce incidents & accidents, the industry must be bold and be ready to invest in the right solutions like proper technology
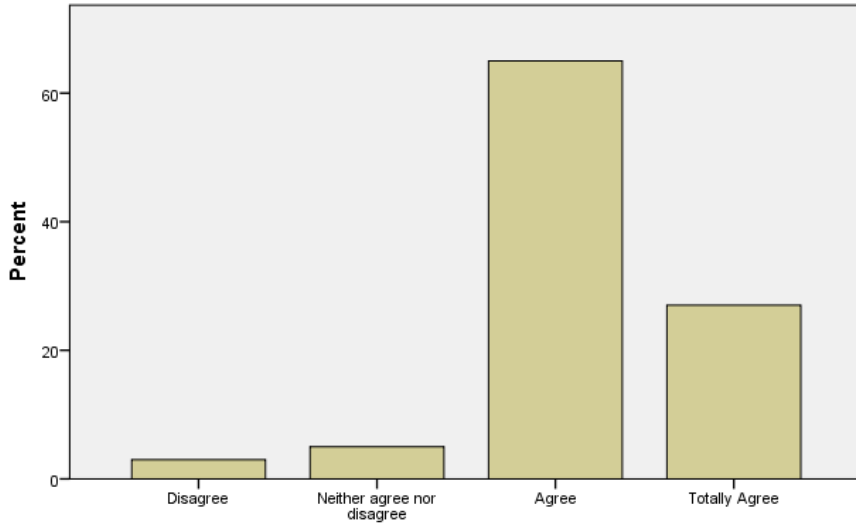
Question 5

The 65% of the participants said that they agree with the fact that due to the fact that crew members are from different ethnicities, misunderstandings and possible danger for incidents or accidents can be provoked and a 27% totally agreed.

5.Do you believe that due to the fact that crew members are from different ethnicities, these can provoke misunderstandings and possible danger for incidents or accidents?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	3	3,0	3,0	3,0
	Neither agree nor disagree	5	5,0	5,0	8,0
	Agree	65	65,0	65,0	73,0
	Totally Agree	27	27,0	27,0	100,0
	Total	100	100,0	100,0	

5.Do you believe that due to the fact that crew members are from different ethnicities, these can provoke misunderstandings and possible danger for incidents or accidents?

Question 6

The 50% of the participants said that they totally agreed with the fact that the lack of experience from part of crew members is possible danger for incidents or accidents and a 48% agreed as well.

6.Do you believe that the lack of experience from part of crew members is possible danger for incidents or accidents?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neither agree nor disagree	2	2,0	2,0	2,0
	Agree	48	48,0	48,0	50,0

| | Totally Agree | 50 | 50,0 | 50,0 | 100,0 |
| | Total | 100 | 100,0 | 100,0 | |

6.Do you believe that the lack of experience from part of crew members is possible danger for incidents or accidents?
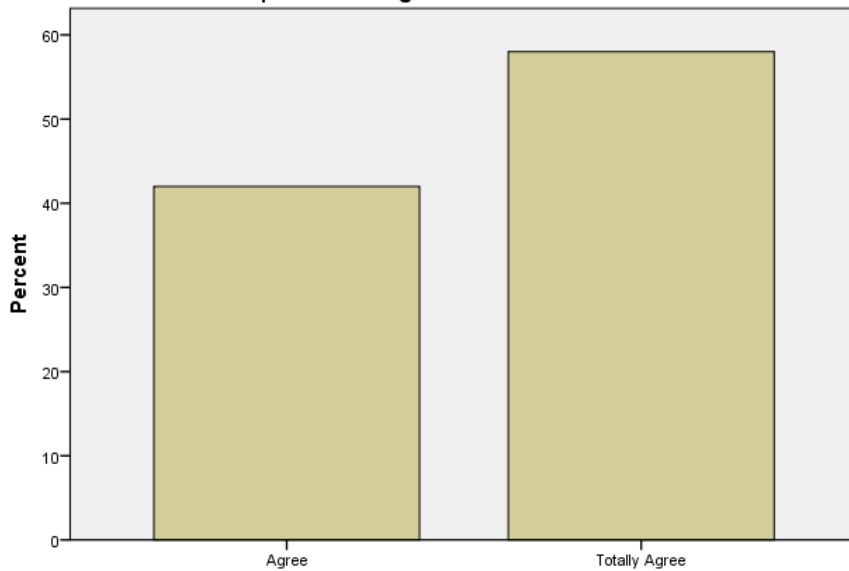
Question 7

The 58% of the participants said that they totally agreed with the fact that the lack of general technical knowledge from part of crew members is possible danger for incidents or accidents and a 42% agreed as well.

7.Do you believe that the lack of general technical knowledge from part of crew members is possible danger for incidents or accidents?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	42	42,0	42,0	42,0
	Totally Agree	58	58,0	58,0	100,0
	Total	100	100,0	100,0	

7.Do you believe that the lack of general technical knowledge from part of crew members is possible danger for incidents or accidents?
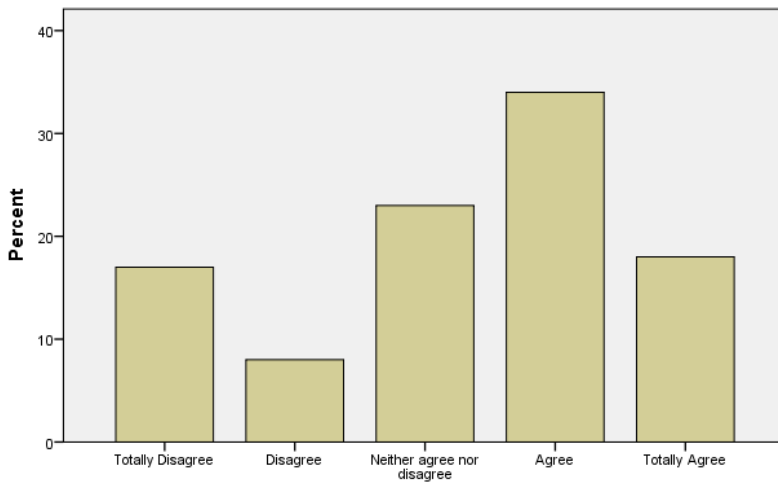
Question 8

The 34% of the participants said that they agreed with the fact that the lack of knowledge of how to handle cargoes, especially of flammable ones, from part of crew members is possible danger for incidents or accidents, the 23% neither agreed nor disagreed, an 18% totally agreed whereas a 17% totally disagreed.

8.Do you believe that the lack of knowledge of how to handle cargoes, especially of flammable ones, from part of crew members is possible danger for incidents or accidents?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Totally Disagree	17	17,0	17,0	17,0
	Disagree	8	8,0	8,0	25,0
	Neither agree nor disagree	23	23,0	23,0	48,0
	Agree	34	34,0	34,0	82,0
	Totally Agree	18	18,0	18,0	100,0
	Total	100	100,0	100,0	

8.Do you believe that the lack of knowledge of how to handle cargoes, especially of flammable ones, from part of crew members is possible danger for incidents or accidents?

8.Do you believe that the lack of knowledge of how to handle cargoes, especially of flammable ones, from part of crew members is possible danger for incidents or accidents?
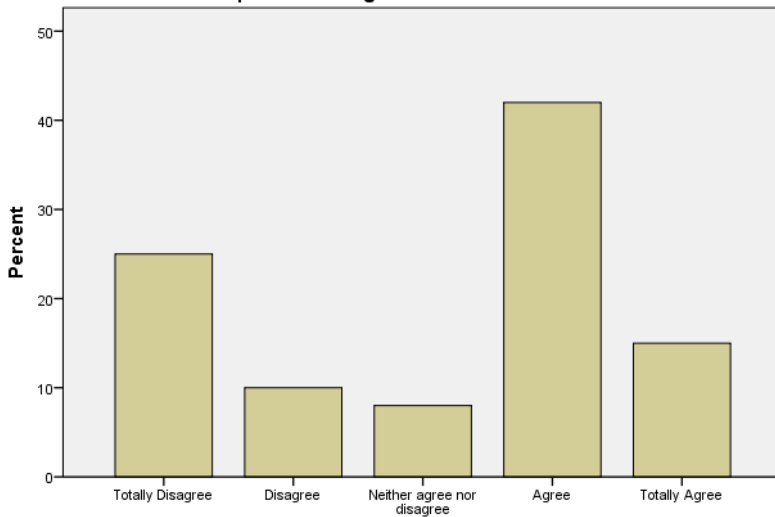
Question 9

The 42% of the participants said that they agreed with the fact that inadequate knowledge of ship's system, from part of crew members is possible danger for incidents or accidents, the 25% totally disagreed, a 15% totally agreed whereas a 10% disagreed.

9.Do you believe that inadequate knowledge of ship's system, from part of crew members is possible danger for incidents or accidents?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Totally Disagree	25	25,0	25,0	25,0
	Disagree	10	10,0	10,0	35,0
	Neither agree nor disagree	8	8,0	8,0	43,0
	Agree	42	42,0	42,0	85,0
	Totally Agree	15	15,0	15,0	100,0
	Total	100	100,0	100,0	

9.Do you believe that inadequate knowledge of ship's system, from part of crew members is possible danger for incidents or accidents?
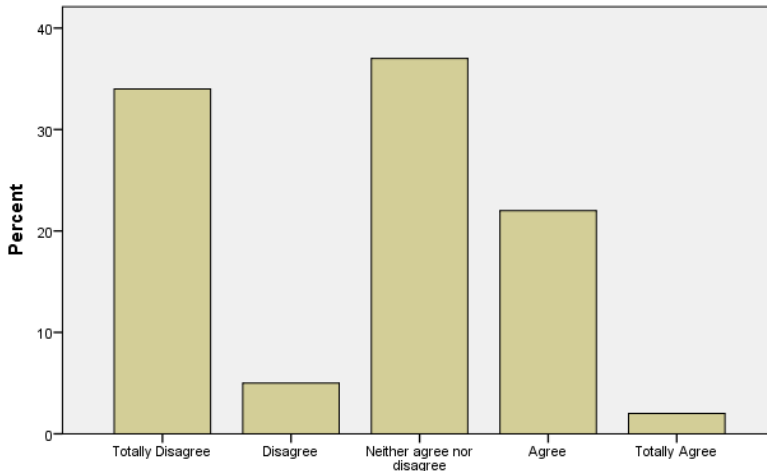
Question 10

The 37% of the participants said that they neither agree nor disagree with the fact that the lack of awareness of the seriousness of the jeopardies of the job from part of crew members is possible danger for incidents or accidents, the 34% totally disagreed whereas a 22% agreed.

10.Do you believe that the lack of awareness of the seriousness of the jeopardies of the job from part of crew members is possible danger for incidents or accidents?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Totally Disagree	34	34,0	34,0	34,0
	Disagree	5	5,0	5,0	39,0
	Neither agree nor disagree	37	37,0	37,0	76,0

Agree	22	22,0	22,0	98,0
Totally Agree	2	2,0	2,0	100,0
Total	100	100,0	100,0	

10.Do you believe that the lack of awareness of the seriousness of the jeopardies of the job from part of crew members is possible danger for incidents or accidents?

10.Do you believe that the lack of awareness of the seriousness of the jeopardies of the job from part of crew members is possible danger for incidents or accidents?
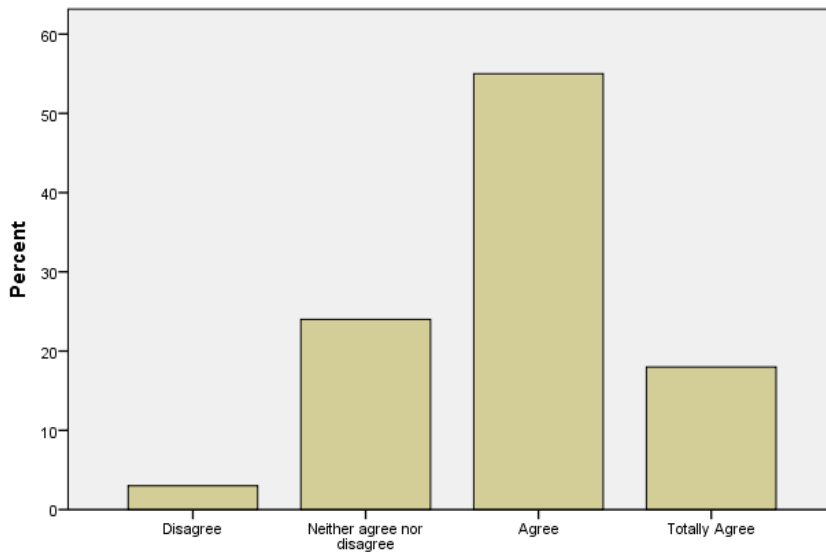
Question 11

The 55% of the participants said that they agreed with the fact that work overload from crew members is possible danger for incidents or accidents, a 24% neither agree nor disagree and a 18% totally agreed.

11.Do you believe that the work overload from crew members is possible danger for incidents or accidents?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	3	3,0	3,0	3,0
	Neither agree nor disagree	24	24,0	24,0	27,0
	Agree	55	55,0	55,0	82,0
	Totally Agree	18	18,0	18,0	100,0
	Total	100	100,0	100,0	

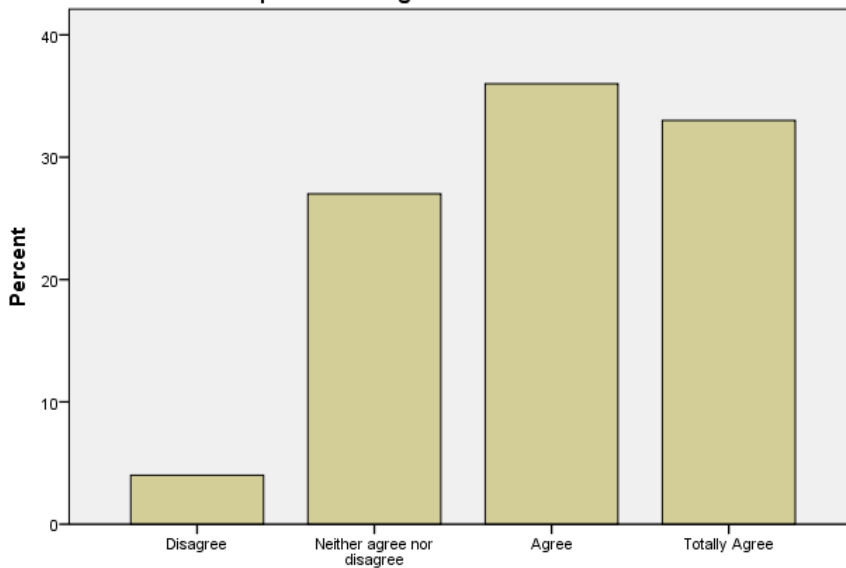11.Do you believe that the work overload from crew members is possible danger for incidents or accidents?

Question 12

The 36% of the participants said that they agreed with the fact that decisions based on incomplete information from crew members is possible danger for incidents or accidents, a 33% totally agreed whereas a 27% neither agreed nor disagreed.

12.Do you believe that decisions based on incomplete information from crew members is possible danger for incidents or accidents?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	4	4,0	4,0	4,0
	Neither agree nor disagree	27	27,0	27,0	31,0
	Agree	36	36,0	36,0	67,0
	Totally Agree	33	33,0	33,0	100,0
	Total	100	100,0	100,0	

12.Do you believe that decisions based on incomplete information from crew members is possible danger for incidents or accidents?
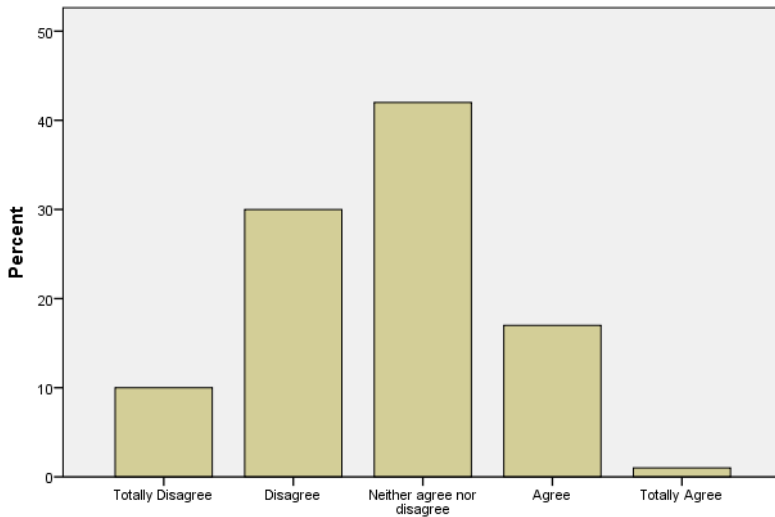
Question 13

The 42% of the participants said that they neither agreed nor disagreed with the fact that poor maintenance is possible danger for incidents or accidents, a 30% disagreed whereas a 17% agreed.

13.Do you believe that poor maintenance is possible danger for incidents or accidents?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Totally Disagree	10	10,0	10,0	10,0
	Disagree	30	30,0	30,0	40,0
	Neither agree nor disagree	42	42,0	42,0	82,0
	Agree	17	17,0	17,0	99,0
	Totally Agree	1	1,0	1,0	100,0
	Total	100	100,0	100,0	

13.Do you believe that poor maintenance is possible danger for incidents or accidents?
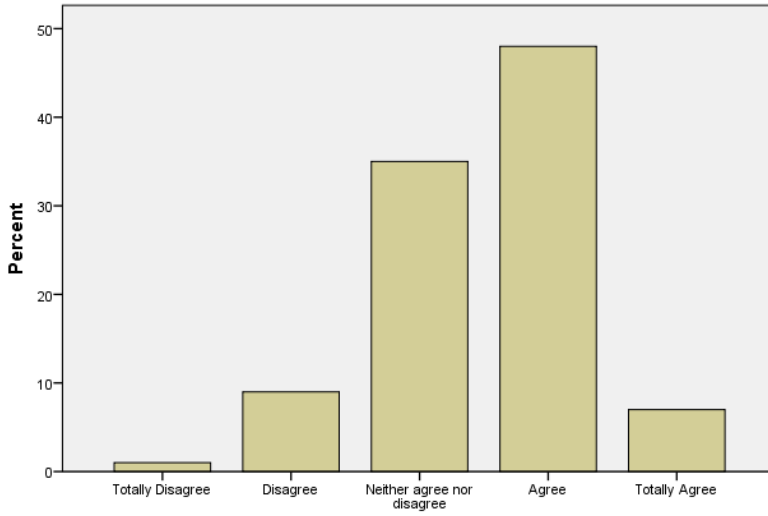
Question 14

The 48% of the participants said that they agreed with the fact that the lack of emergency drills is possible danger for incidents or accidents and a 35% neither agreed nor disagreed.

14.Do you believe that the lack of emergency drills is possible danger for incidents or accidents?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Totally Disagree	1	1,0	1,0	1,0
	Disagree	9	9,0	9,0	10,0
	Neither agree nor disagree	35	35,0	35,0	45,0

|				
Agree	48	48,0	48,0	93,0
Totally Agree	7	7,0	7,0	100,0
Total	100	100,0	100,0	

14.Do you believe that the lack of emergency drills is possible danger for incidents or accidents?

Question 15

The majority of the participants (51%) were over 46 years old, the 40% were from 36-45 years old and the rest 9% were from 18-35 years old.

15.Age

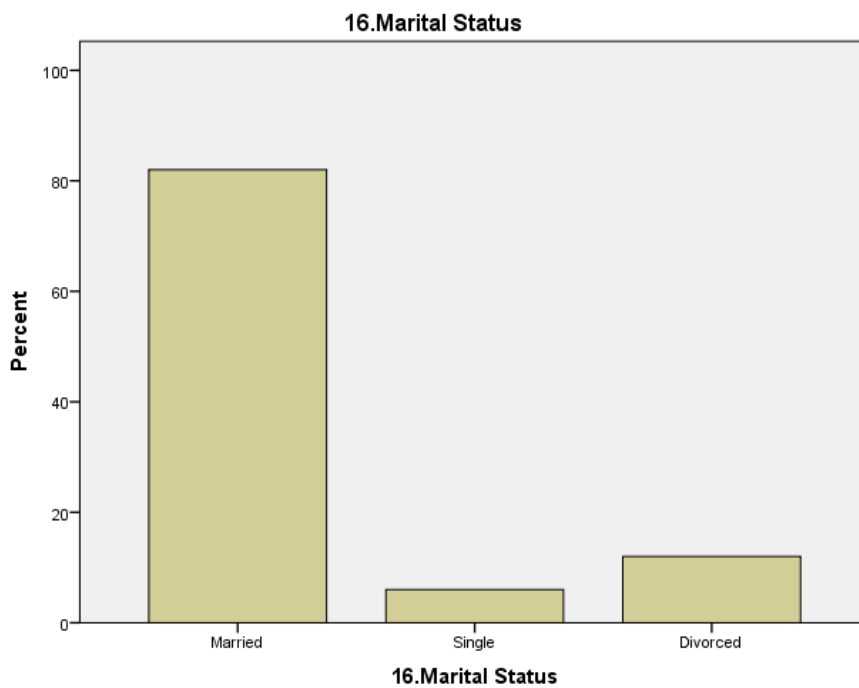|		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-29	5	5,0	5,0	5,0
	30-35	4	4,0	4,0	9,0
	36-40	20	20,0	20,0	29,0
	41-45	20	20,0	20,0	49,0
	46+	51	51,0	51,0	100,0
	Total	100	100,0	100,0	
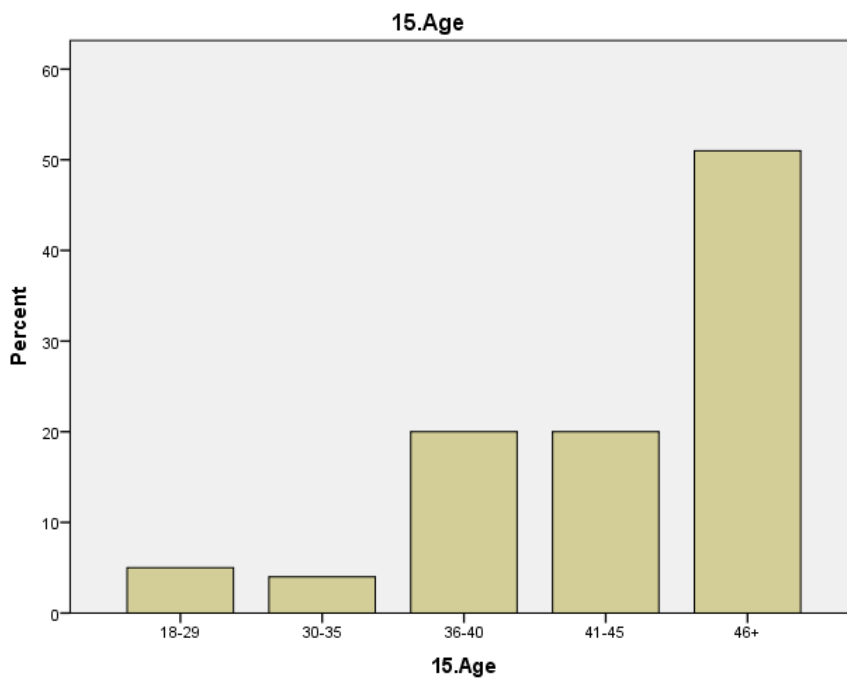
Question 16

The 82% of the participants were married, the 12% were divorced and the rest 6% were single.

16.Marital Status

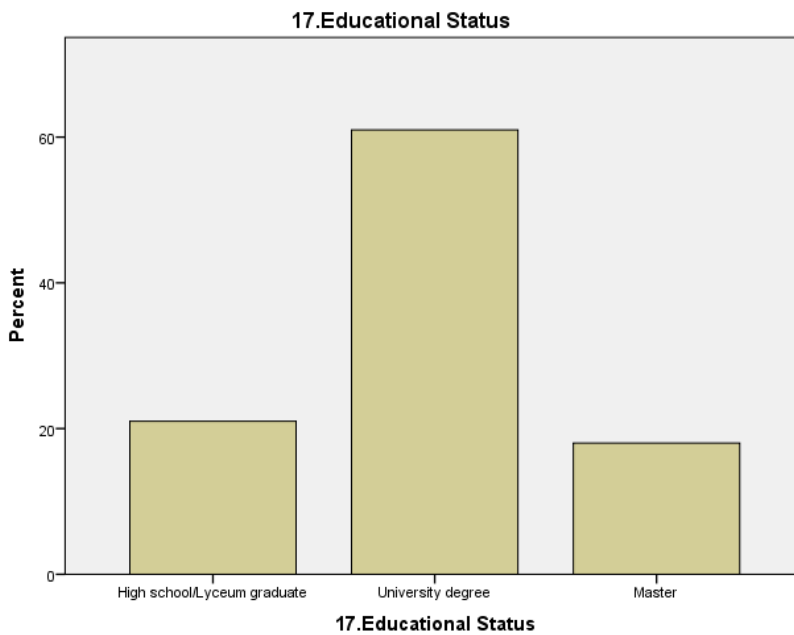|		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Married	82	82,0	82,0	82,0
	Single	6	6,0	6,0	88,0
	Divorced	12	12,0	12,0	100,0
	Total	100	100,0	100,0	

16.Marital Status

Question 17

The 61% of the participants were university graduates, the 21% high school graduates and the rest 18% had a Master.

17.Educational Status

		Frequency	Percent	Valid Percent	Cumulative Percent

Valid	High school/Lyceum graduate	21	21,0	21,0	21,0
	University degree	61	61,0	61,0	82,0
	Master	18	18,0	18,0	100,0
	Total	100	100,0	100,0	

17.Educational Status

Question 18

The 39% of the participants had from 6-10 years of experience in Shipping, the 37% had over 16 years of experience, the 15% 11-15 years and the rest 9% from 1-5 years.

18.Working Experience

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	1-5 years	9	9,0	9,0	9,0
	6-10 years	39	39,0	39,0	48,0
	11-15 years	15	15,0	15,0	63,0
	16 years +	37	37,0	37,0	100,0
	Total	100	100,0	100,0	

18.Working Experience

4.2   Synopsis of the Results

According what was mentioned above with the questionnaires' results, it should be said the 81% of the participants consider Safety Management in Shipping important and the 10% moderately important, the 54% of the participants said that the Shipping company they work for, consider extremely important that the employees/crew have read the safety regulations and the 38% consider it important as well, the 64% of the participants said that they agree with the statement that "the crew spends more time filling out forms and less time actually focusing on the safety elements of their position" whereas a 17% totally disagree and the 58% of the participants said that they neither agree nor disagree with the statement that in order to meaningfully reduce

incidents & accidents, the industry must be bold and be ready to invest in the right solutions like proper technology, whereas a 20% disagree and an 18% agreed with the above statement.

In advance, the 65% of the participants said that they agree with the fact that due to the fact that crew members are from different ethnicities, misunderstandings and possible danger for incidents or accidents can be provoked and a 27% totally agreed, the 50% of the participants said that they totally agreed with the fact that the lack of experience from part of crew members is possible danger for incidents or accidents and a 48% agreed as well, the 58% of the participants said that they totally agreed with the fact that the lack of general technical knowledge from part of crew members is possible danger for incidents or accidents and a 42% agreed as well, the 34% of the participants said that they agreed with the fact that the lack of knowledge of how to handle cargoes, especially of flammable ones, from part of crew members is possible danger for incidents or accidents, the 23% neither agreed nor disagreed, an 18% totally agreed whereas a 17% totally disagreed and the 42% of the participants said that they agreed with the fact that inadequate knowledge of ship's system, from part of crew members is possible danger for incidents or accidents, the 25% totally disagreed, a 15% totally agreed whereas a 10% disagreed.

Moreover, the 37% of the participants said that they neither agree nor disagree with the fact that the lack of awareness of the seriousness of the jeopardies of the job from part of crew members is possible danger for incidents or accidents, the 34% totally disagreed whereas a 22% agreed, the 55% of the participants said that they agreed with the fact that work overload from crew members is possible danger for incidents or accidents, a 24% neither agree nor disagree and a 18% totally agreed and the 36% of the participants said that they agreed with the fact that decisions based on incomplete information from crew members is possible danger for incidents or accidents, a 33% totally agreed whereas a 27% neither agreed nor disagreed.

Finally, the 42% of the participants said that they neither agreed nor disagreed with the fact that poor maintenance is possible danger for incidents or accidents, a 30% disagreed whereas a 17% agreed and the 48% of the participants said that they agreed with the fact that the lack of emergency drills is possible danger for incidents or accidents and a 35% neither agreed nor disagreed.

5th Chapter – Conclusion

As can be seen from the present work, the human factor is the most important component of business, and this is even more true in the field of shipping. The human resources are directly linked to the success or failure of the business and the achievement of its goals. Therefore, its proper management is critical.

However, the ever-changing environment, i.e. the daily business competition and constant pressures force businesses to change and adapt to new conditions. This is exactly the role of the Human Resources Management department, to organize and if necessary, to change the company's potential, with the aim of obtaining a competitive advantage, but also the survival of the company itself. Human Resource Management is not a simple process. It consists of partial stages and functions that must be completed in the appropriate order for the proper operation of the business and the achievement of its goals.

In particular, in the management of a shipping company, the situation is more complicated, due to the existence of two different workplaces and therefore human resources: the shore staff who work in the offices of the shipping company, and the sea staff, who work on the ships that the company manages. The management of the potential of these two spaces presents several differences that must be taken into account, since the staff itself is very different between these two spaces. The purpose of the Human Resources Management department is to manage to organize the operation of the two departments separately, but also to achieve their effective cooperation.

The safety of ships at sea has always been, and will never cease to be, the biggest concern in the field of shipping. The concern for safety is multiplied in the case of passenger ships which undertake the transportation of thousands of human lives. Its improvement, as it cannot be fully guaranteed, is always the goal of all those involved in the field. The dissatisfaction is caused,

however, by the fact that these actions are, most of the time, spasmodic and are usually done after a major accident with the main purpose of mitigating the reactions of public opinion.

Thus, shipping, in the area of safety, is a step behind others such as the aviation industry, and as a result it is often in the difficult position of listing damages either to the environment and cargo or, worse still, to human lives, where the effects and reactions are much greater, which is completely justified. The significant influence of the human factor in causing maritime accidents as the main cause of an accident together with other factors, which are proven to play an important role in the safety of a ship, are the age, the size of the ship and the type of accident.

There is a tendency to make a distinction between the term human factor and human error. In fact, two different definitions have prevailed for these two terms. Thus, the definition of the human factor covers a wide range of issues related to environmental, organizational and work factors, the design of the system, the particular characteristics of the project and the person that influence behavior and affect health and safety. The definition of human error, whether intentional or unintentional, is defined as: any human action, or lack thereof, that exceeds or fails to reach a level of acceptance where the limits of human behavior are set by the system. The conclusion that can be drawn from the comparison of the two definitions is that the term human factor is more general than the term human error and includes all accidental omissions in the planning and organization of a business or project.

But the boundaries between them are not fully defined and many times their separation is very difficult. This fact, together with the lack of precise information from the database, as to the cause of an accident, led to the decision to consider these two terms almost identical. The development of interest in the involvement of the human factor in accidents seems that initially, attention was focused on technical problems, a point that has, of course, not ceased to concern even today.

However, as technical systems became more and more reliable over time, attention focused on human causes and many accidents were attributed entirely to people with direct access to handling. Later, serious accident investigations recognized that the failure of equipment and operators was rooted deeper in the management and process of safety rules. Analyzes of the causes of accidents reveal that in up to 80% of accidents, there is complete, or even partial, human involvement. It has been estimated that human error is behind approximately 60% of all maritime accidents, with organizational and administrative failures accounting for 15%, while the remaining 25% is attributed to technical problems. Additionally, of the human error cases, only 20% were caused by purely individual operator error. The remaining 80% is attributed to many other factors that affect the functionality of a ship.

Therefore, the problems caused by this factor are often unavoidable. In some cases, people will always be wrong, and there is a limit to what we can do to change that given situation. Since it is inevitable that mistakes will occur, our focus is on reducing the likelihood of these mistakes occurring and minimizing the consequences they can cause. In widespread disasters, the stated cause as "human error" is usually identified with the wrong action of the employee involved, but a share of responsibility often rests with the designers - manufacturers of a system.

Several studies have addressed the problem of designing systems for improved security. In workplaces with strict safety criteria, a large number of checks and inspections are carried out. For an accident to occur, there must be a combination of oversights and mistakes across all the different levels of safety and organization. The chances of an accident occurring can be reduced precisely by limiting the gaps that exist at each stage of a process.

It is clear that the gradual narrowing of gaps will lead to a dramatic reduction in the overall probability of an accident. Thoughtful planning can reduce the omissions hidden at the administrative level, attention to the needs of the workers can limit the errors caused by the psychological domain, and better design-safety cooperation can largely eliminate unsafe actions that it is possible to lead to an accident.

Continuous education, proper training, good management of hours and volume of work are some of the factors that can lead to the elimination of some mistakes. However, errors that have as their source the limits of human capabilities and/or the unexpectedness of the environment are best reduced by improving the interaction of system design with safety culture. Essentially in today's demanding environment, bridge / engine officers must be very well prepared to be able to also comply with a complex legal - regulatory regime and at the same time operate their ships in a safe, threat-protected, efficient and friendly manner. the surrounding way. They need to manage operational risks, successfully deal with adversity and, as members of the bridge/engine team, maintain appropriate behavior.

Consequently, shipping companies must ensure that Masters / First Engineers (old and new), Mates / Second Engineers, Second Mates / Third Engineers and all bridge / engine watch officers (even deck mates / engine room), are well versed in new technologies on the bridge/engine room and are able to interact as best as possible with other officers, pilots and equipment on the bridge/engine room, both under normal conditions and in distress situations.

Suggestions for the Future Research

An appropriate system should not allow humans to make mistakes easily. This may sound obvious, but it doesn't always happen in practice and one of the main reasons is the absence of all the authorities from the planning. These are none other than the potential future users of the systems and this, precisely, their absence often makes their familiarization with the system difficult and problematic. A number of rules have been proposed, which aim to minimize the possibility of error. These suggestions are:

✓   Accurate mental models - There is often a mismatch between the state of the system and the model that its users have in mind. The frequent cause of wrong behavior and treatment

towards the system by the users, is that they themselves are very rarely the initiators of it. Designers must manage to find a balance between the system and the expectations and will of the users. A prime example of the importance of familiarizing the user with the work system is demonstrated by the research of a laboratory which examined whether it is useful to give staff a general overview of the equipment structure and the day-to-day operation of the laboratory. One group of workers was given simple instructions on which buttons to press if a dangerous situation occurred, while the other group, in addition to the instructions, was given an analysis of the operation of the laboratory. Both groups dealt with the expected problems with equal ease, but when new difficulties appeared, only the second group was able to deal with them.

✓   <u>Information management</u> - As human attention can easily be distracted and this leads to the omission of important stages of a project, it makes sense to provide information within the work environment, which is an aid in the fulfillment of complex issues. For example, the omission of some steps during maintenance is considered the main cause of accidents, as under time pressure, technicians are likely to forget some of the steps of their work. A very simple solution to this problem is to equip the technicians with computers in order to electronically verify the completion of each stage. This move would also help in reducing bureaucratic work and thus saving time.

✓   <u>Limitation of complexity</u> - By simplifying the structure of the systems, as much as possible, the "overloading" of the psychological process and human capabilities analyzed above can be avoided. The more complex the system properties, the greater the potential for human error.

✓   <u>Visibility</u> - The user must be able to discern which actions are feasible in a system and, in addition, which actions are desirable. This reduces the demands on analytical thinking in choosing between a range of possible actions. Perhaps even more important is the good quality of the feedback that allows users to judge how effective the moves they made were and what the new state of the system is as a result of those moves.

✓   <u>Limitation of actions</u> - If a system had the ability to prevent any dangerous action by the user, then no accident would occur. Of course, this is a utopia for today's complex work systems. After all, a process that can be destructive in one phase, could be life-saving in another. However, it is possible to limit human error, with careful application of "forced actions". A case in point is the implementation in ATMs of the "forced action" of the card being ejected from the machine before

the cash is dispensed, thus protecting users from their frequent habit of forgetting their card in the machine. Such restrictions essentially free the user from the responsibility of deciding: "what actions should I follow to interact properly with the system?" and, above all, they decisively prevent unwanted effects.

✓ Error handling - In most workplaces with strict safety criteria, a large number of safety systems are installed to prevent accidents. One approach is "defense in depth" / implementing many independent systems simultaneously, another is "failover". The originators of systems must, in their design, take for granted that errors and omissions will occur, and so for a system to be useful care must be taken to restore it, after these errors, to a state of correctness. operation. Another consideration is that the system should prevent false actions. Although this is one of the basic design principles, it needs to be noted and applied with great care.

✓ Standardization - When systems are – necessarily – complex but have been made as accessible and user-friendly as possible, and yet errors still occur, then standardization is used to limit them, making the state of the system more predictable. One problem that exists with standardization is that if, indeed, its establishment brings beneficial results, then redesigning the entire system or even replacing some machines is usually an extremely expensive process. Also, standardization can often prove to be ideal for one area of the system, but inadequate for another. Such practical, yet important, reasons tend to limit the application of standardization as a means of limiting human error.

✓ User-centered design - Another key principle of design is that it should be user-centered in all, without exception, the – stages – from initial conception to fulfillment through evolution and continuous testing. In practice, however, things are often very different. The initiators of the systems, with the help of a brief report, create the system and, in effect, impose it on its users without proper feedback from them. This can result in unpredictable system behavior and an over-reliance on manuals, which were also written from the perspective of the system's creators. Systems designed under these conditions will appear "dull" to the end user and this will certainly hinder their effective interaction with them.

References

Greek Bibliography

Alexopoulos Arist. B. and Fournaraki Nik. C., "International Regulations – Shipping Politics and Law of the Sea", 3rd edition, Eugenides Foundation, Athens, 2015

Biliri N., "Human Resource Management Practices in Modern Businesses", University of Patras, 2011

Bourandas A., Vathis A., Papakonstantinou X., Rekleitis P., "Principles of Organization and Management of Businesses and Services", 3rd Grade General High School, Teaching Books Publishing Organization Athens, 1999

Bouradas D., "Management - theoretical background & modern practices, Benou publications, 2002

Bourandas D., Papalexandri N., "Human Resources Management", G. Benou publications, 2003

Chytiris L., "Human Resource Management", Interbooks publications, Athens, 2001

Fanarioti P., "Labor Relations", 2nd edition, Athens: Stamoulis, 2004

Kanellopoulos H. K., "Management of Personnel - Human Resources", private edition 6, 2002

Maltezos S. A., "The Management of Human Resources in Shipping", University of Piraeus, 2013

Palamiotou K. K, "Human Relations", Eugenides Foundation, Athens: 2013

Papalexandri N., Bourandas D, "Effective Human Resources Management", G. Benou publications, 2002

Sideris I., professor of the Merchant Marine Academy of Macedonia, lecture notes in the courses "Human Relations" 5th semester, "Human Resources Management" 4th semester, "International Maritime Policy-Law of the Sea" 6th semester

Tzortzakis K., Tzortzakis A. M., "Organization and Management, the Management of the new era, 4th edition, Athens: Rossili, 2007

Vaxevanidou M., Rekleitis P., "Management of Human Resources", Athens: Propompos,

2008

Xenos D., "Human Resource Management Systems for Application in Businesses and Public Organizations", Athens: Papazisi, 2003

Xirotyris Koudidou S., "Human Resource Management - The challenge of the 21st century in the working environment, Anikula publications, 2001

English Reference

Armstrong M., «A Handbook of Human Resources Management», Practice 13th edition, London: Kogan Page, 2014

Armstrong M., «Strategic Human Resource Management: a guide to action», London: Kogan Page, 2000

Calixto, E., Lima, G. and Firmino, P. (2020). Comparing SLIM, SPAR-H and Bayesian Network Methodologies.

Chauvin, C. (2011). Human Factors and Maritime Safety. Journal of Navigation, 64(4), pp.625-632.

Cooper, S., Ramey-Smith, A., Wreathall,, J., Parry, G., Bley, D., Luckas, W., Taylor, J. and Barriere, M. (1996). A technique for human error analysis (ATHEANA). Oak Ridge, Tenn.: Distributed by the Office of Scientific and Technical Information, U.S. Dept. of Energy.

Harrald, J., Mazzuchi, T., Spahn, J., Van Dorp, R., Merrick, J., Shrestha, S. and Grabowski, M. (1998). Using system simulation to model the impact of human error in a maritime system. Safety Science, 30(1-2), pp.235-247.

Hetherington, C., Flin, R. and Mearns, K. (2006). Safety in shipping: The human element. Journal of Safety Research, 37(4), pp.401-411.

IMO Guidance on Near Miss Reporting. IMPLEMENTING An effective SAFETY CULTURE Basic Advice for Shipping Companies and Seafarers (MSC- MEPC.7/Circ.7, October 2008). INTERNATIONAL CHAMBER OF SHIPPING IMO Symposium on the Future of Ship Safety, 2013. www.ics-shipping.org

Jae, M., Park, K. (1995). A new dynamic HRA method and its application. Jurnal of the Korean nuclear society, 27(3), pp.292-300.

Kirwan, B. (1996). The validation of three human reliability quantification techniques — THERP, HEART and JHEDI: Part 1 — technique descriptions and validation issues. Applied Ergonomics, 27(6), pp.359-373.

Kristiansen, S. (2013). Maritime transportation. Oxon [England]: Routledge.

Konstandinidou, M., Nivolianitou, Z., Kiranoudis, C. and Markatos, N. (2006). A fuzzy modeling application of CREAM methodology for human reliability analysis. Reliability Engineering & System Safety, 91(6), pp.706-716.

LEHR, P. (2016). Diploma in Marine Accident Investigation Module 2 – Common Causes of Marine Accidents. LLOYD'S maritime academy. North Kent College

Marseguerra, M., Zio, E. and Librizzi, M. (2006). Quantitative developments in the cognitive reliability and error analysis method (CREAM) for the assessment of human performance. Annals of Nuclear Energy, 33(10), pp.894-910.

Park, K. and Lee, J. (2008). A new method for estimating human error probabilities: AHP–SLIM. Reliability Engineering & System Safety, 93(4), pp.578-587.

Silber, G., Vanderlaan, A., Tejedor Arceredillo, A., Johnson, L., Taggart, C., Brown, M., Bettridge, S. and Sagarminaga, R. (2012). The role of the International Maritime Organization in reducing vessel threat to whales: Process, options, action and effectiveness. Marine Policy, 36(6), pp.1221-1233.

Soares, C. and Teixeira, A. (2001). Risk assessment in maritime transportation. Reliability Engineering & System Safety, 74(3), pp.299-309.

SPURGIN, A. (2010). Human reliability assessment. 1st ed. Boca Raton, Fla: CRC Press.

Ung, S. (2020). A weighted CREAM model for maritime human reliability analysis.

Wieslaw, T. (2012). Origins of Ship Safety Requirements Formulated by International Maritime Organization. Procedia Engineering, 45, pp.847-856.