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## Organizational subcultures and safety culture in shipping: case study of Algeria

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**WORLD MARITIME UNIVERSITY**

Malmö, Sweden

**Organizational Subcultures and Safety Culture in  
Shipping: Case study of Algeria**

By

**KAHLOUCHE NADHIR**

ALGERIA

A dissertation submitted to the World Maritime University in  
partial fulfilment of the requirement for the award of the degree of

**MASTER OF SCIENCE  
In  
MARITIME AFFAIRS**

**(MARITIME SAFETY AND ENVIRONMENTAL ADMINISTRATION)**

2021

## Declaration

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

(Signature): .....

(Date): **20- 09- 2021**

Supervised by: **Dr. Anish Hebbar**

Supervisor's affiliation: **Assistant Professor- WMU**

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## **Abstract**

Title of Dissertation: Organizational Subcultures and Safety Culture in Shipping:  
Case study of Algeria.

Degree: **Master of Science**

This study intends to contribute to the improvement of safety culture of the shipping industry. The study investigates the existence of different subcultures of safety on board ships as a result of differing organizational cultures in shipping companies. In particular, it investigates the way the organizational safety management contributes in creating such safety culture differences in the same shipping company between its different divisions, e.g., international and domestic shipping activities, and therefore affecting safety on board ships.

The study employed an exploratory mixed method design. The qualitative exploratory part, consisting of six interviews with maritime experts, assisted in formulating the research hypothesis and constructing the survey questionnaire. Subsequently, the study was undertaken on a sample of 549 seafarers in Algeria, using the constructed safety culture survey questionnaire. The psychometric priorities of the questionnaire (i.e., validity and reliability) were assessed using Exploratory Factor Analysis (EFA) and Cronbach–Alpha, respectively. Qualitative data was analyzed using content analysis of the interviews, while quantitative data analysis used the Statistical Package for the Social Science (SPSS), including several statistical tests and analyses, among others correlation and regression analyses.

The study yielded seven factors that affect and differ safety culture between ocean-going and domestic ships; three organizational factors, including top management commitment, safety management system, safety related human resources; and four shipboard safety climate factors, including local management commitment, crew psychological safety, crew job satisfaction, and crew safety behavior. In contrast, external supervision, such as port and flag State controls, has shown marginal influence on safety culture in this study.

The study indicates that differing the organizational safety management (i.e., the organizational factors) lead to differing safety culture on board ships (i.e., shipboard safety climate factors). This fact led to state that organizational subcultures in managing safety led to respective safety subcultures.

Furthermore, the study indicates that the organization's top management commitment and the adequate safety management system moderate the impact of deficient local management involvement in safety. However, the study yielded negative impact of the qualified human resources on safety when they exposed to their job dissatisfaction and to bad psychological safety conditions on board ships.

Based on the findings of the study, a safety culture model is graphically presented, which when implemented will have the potential to enhance safety culture in shipping companies, including those engaged in different shipping activities or operated by different entities.

**KEYWORDS:** Safety culture, Safety climate, Organizational culture, Organizational Subcultures, Safety subculture, Safety management, Shipping in Algeria.

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## List of Abbreviations

AGCS	Alliance Global Corporate & Specialty and Watchkeeping for Seafarers
EFA	Exploratory Factor Analysis
HSC	Health and Safety Commission
IAEA	International Atomic Energy Agency
IBM	International Business Machines Corporation
ICS	International Chamber of Shipping
IMO	International Maritime Organization
ISM Code	International Safety Management Code
ISO	International Organization for Standardization
KMO	Kaiser-Meyer-Olkin
MAIB	Marine Accident Investigation Branch
NOSACQ-50	Nordic Occupational Safety Climate Questionnaire
PSC	Port State Control
SAQ	Safety Attitudes Questionnaire
SMS	Safety Management System
SOLAS	International Convention for the Safety of Life at Sea
SPSS	Statistical Package for the Social Sciences
STCW	International Convention for Standards of Training, Certification
UK	United Kingdom
WMU	World Maritime University

# CHAPTER 1: INTRODUCTION

## 1.1. Background

It is often said that safety regulations are not followed adequately because of people's negative attitudes (Mearns et al., 2001). However, usually, individuals' attitudes result from the culture of organizations (Sexton & Klinec, 2017; Choudhry et al., 2007; Flin, 2007; Rundmo et al., 1998; Cox & Cox, 1991). Specifically, as an aspect of organizational culture that reflects the organization's priority placed on safety over other competing concerns such as efficiency and costs, safety culture shapes the individuals' motivation to engage in safe behaviors (Bisbey et al., 2021). Therefore, as a proactive safety approach, safety culture is seen in various industries as an effective strategy for improving safety, especially in high-risk sectors.

Shipping, one of the world's riskiest industries, has also shifted to adopt this proactive approach toward safety through developing an appropriate safety culture. Indeed, under the auspices of the IMO, since the introduction of the ISM Code, safety culture has been widely recognized as one of the most important aspects of maritime safety. In particular, by introducing the ISM Code in 1994, the IMO aimed to create a safety-oriented culture in shipping by establishing Safety Management Systems (SMSs) (Anderson, 2015; Oltedal, 2011).

However, although the maritime industry's SMSs have positively influenced safety on board ships (Jung, 2021), human error is still blamed in 80 to 85% of maritime accidents (Hasanspahić et al., 2021; Baker & McCafferty, 2005). An inadequate safety culture, specifically, is still revealed amongst the main factors leading to human errors. For instance, in recent years, shipping has witnessed tragic accidents, among others, the Italian cruise ship *Costa Concordia* accident in January

2012, the *Norman Atlantic* fire and the sinking of the South Korean *M/S Sewol* in 2014, the grounding of the UK- registered general cargo *Lysblink Seaways* and the Bahamas registered- passenger ship *Hamburg* in 2015, and the Liberian -registered general cargo ship “*SMN Explorer*”, in February 2018. In particular, safety investigations of these accidents revealed several safety failures that could be traced back to organizational failures relative to safety culture, including crew non-compliance with safety management systems.

Therefore, there is a rising need for organizational safety policy to support safety culture in shipping. As stated by a principal inspector of the Marine Accident Investigation Branch (MAIB), the SMSs as a key part of the ISM code philosophy, its success and failure depend, to a large extent, on the organizational safety culture of shipping companies (Withington, 2011).

From another side, the ship’s reliability and the related regulations that are aimed to improve ships’ safety have introduced more complexity to the work environment on board ships. As a result, Today's ship is considered a highly complex socio-technical system (Aylward, 2020; de Vries, 2017), in which the interrelationships between humans and technology are of prime importance in performing operations. Furthermore, humans in their interaction within the system are key to success and failure of the entire system’s safety (Woods & Hollnagel, 2006). In the light of this fact, in shipping, recognizing the complexity of the socio-technical process of ships has led to more focus on the concept of “safety culture” (Griffioen et al., 2021; Håvold & Nasset, 2009).

In practice, attaining positive safety culture that yields tangible safety benefits on board ships depends strongly on the shipping company and the shipboard interactions and commitment toward safety. Indeed, the organization’s commitment toward improving safety has shown a great influence on safety culture in various studies, e.g., Li et al., 2021; Horwitz, 2017; Flin & Murdey, 2007; Neal & Griffin, 2000. However, such a commitment at the organizational level is intrinsically linked to the safety-related organizational culture. In shipping, this latter - the

organizational culture should particularly support and enable the shipping companies' safety management systems (SMSs) to improve, through self-commitment toward safety, principally from the active actors in the front line of maritime safety, the seafarers. This can be achieved mainly if the organizational culture can support and enable safety culture to mature and set it as a main driver for people, any time, in their daily activities.

### 1.2. Problem Statement

Due to the nature of their activities, shipping companies' organizational cultures are rarely homogenous or compact. A ship can be owned by a first entity, operated by a second, and managed by a third entity. Another example is that some shipping companies are engaging in different shipping activities, e.g., international voyages versus domestic voyages, and companies operating both cargo ships and passenger ships. As a result, several organizational subcultures can coexist in the same organization, and overlap and oppose in some cases. The question that arises from this statement is as follows: How does the fact of an existence of different organizational subcultures in the same shipping company affect safety culture?

### 1.3. Aim and Objectives

This study intends to contribute to the safety culture improvement of the shipping industry. It aims specifically to investigate the existence of different subcultures of safety as a result of an existence of different organizational subcultures in the same shipping company.

This aim is researched through the use of a case study of international shipping versus domestic shipping in Algeria. Specifically, the study targeted a shipping company in Algeria operating both ocean-going and domestic ships with interchanging crews. In addition, most of the international Conventions, including the STCW Convention and the ISM Code, are implemented in both types of ships of this shipping company. This case study with such characteristics may allow to investigate whether

the same people with the same regulatory setting will have diverse safety cultures, and therefore behave differently if they are exposed to different organizational cultures.

To achieve the research aim, the study progresses according the following three objectives:

1. The study looks for identifying the key elements that influence safety culture within international and domestic shipping activities.
2. The study examines the existence of different subcultures of safety as a result of the organizational subcultures in the same shipping company.
3. The study intends to investigate the way the shipping company management of safety can improve safety culture of domestic ships and align it with the one of the ocean-going ships.

The first and the third research objectives are investigated through two research questions Q1 and Q2, respectively:

Q1: What are the factors that influence safety within international and domestic shipping activities and bearing on safety culture?

Q2: In what way does a shipping company safety management contribute to a difference in safety culture between its different divisions such as for example, international and domestic shipping divisions?

The second research objective is investigated through validating a hypothesis H1: The organizational subculture affects safety culture and results in respective subcultures of safety in the same organization, even with the same employees with the same qualifications.

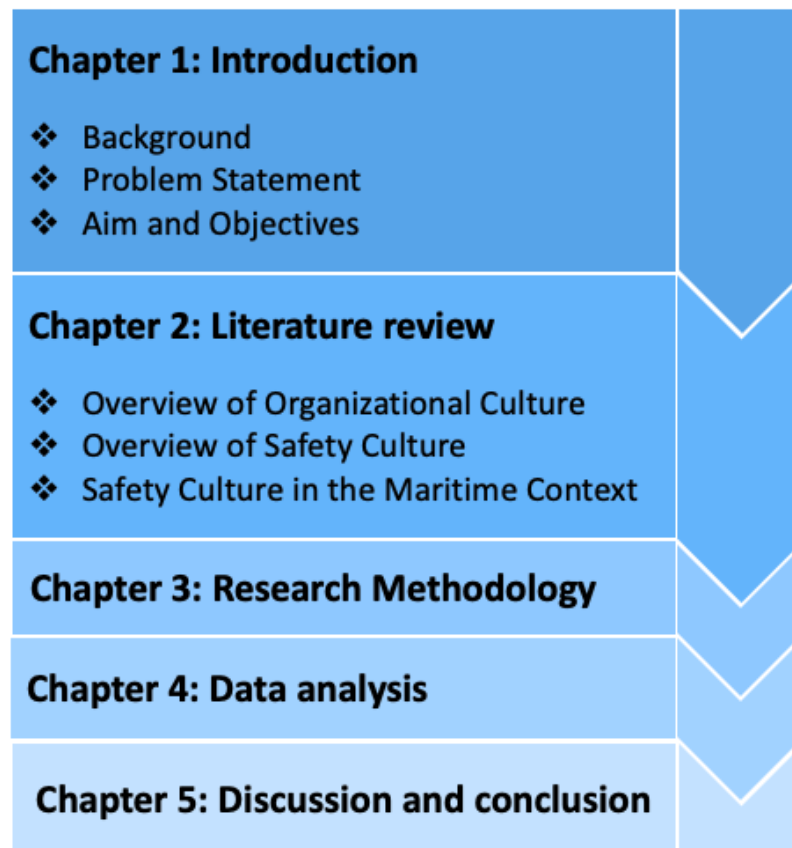
#### 1.4. Composition of the Dissertation

The dissertation consists of five chapters, as described in [Figure 1](#):

- Chapter one contains the background, the problem statement, the aim and objectives, and the dissertation structure.



- Chapter two consists of a literature review, focusing mainly on the organizational culture and safety culture including safety culture in shipping.
- Chapter three discusses the methodology used in this study and explains detailed processes for the questionnaire survey and the personal interviews.
- Chapter four describes and analyses the results of the questionnaires and interviews.
- Finally, chapter five discusses the research outcomes. In addition, it provides conclusions and recommendations for the research study.



*Figure 1. Composition of the Dissertation*

## **CHAPTER 2: LITERATURE REVIEW**

### **2.1. Introduction**

Developing a positive safety culture has been perceived, in various industries, as an effective strategy to improve safety. Thus, multiple studies and extensive related literature have explored distinct factors affecting safety culture directly or indirectly. Steve, Flin, and Murdey (2007) identified the organization's commitment and workforce involvement as the only two factors replicated across studies. Indeed, recent studies, e.g., Li et al., (2021) and Horwitz, (2017) have commonly recognized the critical role of these two variables in successfully establishing a culture of safety in an organization. These two variables, besides being critical components of safety culture, they are intrinsically linked to the organizational culture. However, it is commonly accepted that organizations rarely have a compact and homogeneous culture, rather, several subcultures can interact within the same organizations, especially in big and multinational organizations (Schein, 2010; Antonsen, 2009; Reason, 1997; Schein, 1991). In particular, this fact of different subcultures, as stated by Pidgeon (1998, p208), might result in divergence in priorities and commitments.

Therefore, this study first compares the safety culture of Algerian maritime companies engaging in both international and domestic shipping activities. Then, in line with the relevant research, the study investigates the existence of different subcultures of safety, e.g., district priorities and commitment toward safety, as a result of an existence of different organizational subcultures in the same shipping company. Particularly, the study looks for the way by which the organizational factors, such as the top management commitment, contribute to creating such safety subcultures, and consequently influence the shipboard involvement in safety and the overall safety culture of ocean-going and domestic ships.

First, the broader theoretical framework of organizational culture and safety culture will be examined. Then, safety culture in shipping and the related organizational culture roles will be discussed.

## 2.2. Overview of Organizational Culture

Over the last decade, there has been a great deal of literature produced about the concept of organizational culture. In particular, there has been a great emphasis on how to successfully undertake organizational changes, which must involve not only the corporate structures and processes, but also include cultural aspects (Guldenmund, 2010). Therefore, this section will first discuss the "culture" and its link to organizations.

### 2.2.1. Culture

Whether we like it or not, everyone is born in a society and develops within a specific cultural horizon in which people are simultaneously creators and receivers of culture (Griswold, 2012, p15). According to Alexander et al. (1990, p8), culture and society are two interdependent concepts; while people are the main component of society, ideas, behaviors, and material possessions constitute culture. This latter, in various disciplines, has been an important area of interest.

Although the term "culture" has attracted significant attention, there is no standard definition of this complex term (Hofstede, 2011). However, researchers have attempted to establish definitions of the concept differently, resulting in a wide range of definitions. As postulated by Hinkle and Long (1999), "It may not be an exaggeration to say that there are nearly as many definitions of culture as there are fields of inquiry into human societies, groups, systems, behaviors and activities" (p.01). Schein (1991), for instance, defines culture as "a pattern of shared basic assumption, invented, discovered, or developed by a given group" (p.318). From another angle, Kramsch and Widdowson (1998) refer to culture as "a membership in a discourse community that shares a common social space and history, and common imaginings" (p.10). Similarly, Cohen (2009) indicated that culture also could be perceived to refer to ethnicity, nationality, or a set of groups of people sharing specific

attributes. Although these definitions comprise distinct vocabulary, they commonly link culture to society members' shared concepts, such as norms, values, and behaviors obtained and developed in social institutions such as family and school.

Furthermore, there is a common agreement that understanding culture is key to comprehending how people behave either in the workplace or in their homes (Cummings & Worley, 2014; Richerson & Boyd, 2008; Hofstede et al., 2005; Holt & Wigginton, 2002). In the workplace, for instance, it is strongly believed that authority, leadership, attitudes, and practices emanate from a society's culture (Holt & Wigginton, 2002). Therefore, for organizations, there is a strong belief that change can be effectively achieved merely by designing an influential force that could positively impact people's interests and values with respect to their culture (Thomson & Martin, 2005).

Therefore, for an organization, as stated by Ille and Chailan (2011), understanding and considering cultural aspects remain strategic factors in strategic decisions that can be used to operate effectively and competitively, especially in particular regions with specific cultures. This organization's informal aspect of performing is described as the organizational culture (Guldenmund, 2010).

### 2.2.2. Organizational Culture

Three essential components can be identified in organizations and their activities, namely structure, processes, and culture (Antonsen, 2009; Guldenmund, 2010). The organizational structure is about the formal aspects that determine how an organization achieves its missions and by whom. It may include infrastructures, distribution of tasks, and the related responsibilities and authority. The organizational processes refer to the core business of the organization and the associated processes that may include management, social and interactional processes, and systems. On the other hand, the organizational culture, also called corporate culture, is more about the informal aspect of organizing and executing tasks. It is about what employees in the organization value or do not value things as necessary (Guldenmund, 2010). This "informal aspect" of the organizations, as described by Guldenmund (2010), has

attracted increasing attention over the years, resulting in the extensive published literature on the topic.

#### 2.2.2.1. Background and Definition

Most of today's organizational culture literature is traced back to Schein's work in the early 1980s; however, its first studies are grounded in anthropology and folklore studies that date back to the 1940s (Alvesson, 2012, p6; Baker, 2002; Hatch, 1993). Although academic researchers were not quite sure about the meaning of culture, and even the way to link it to organizations and their business success, there was an agreement upon the vital role that organizational culture plays in affecting and reflecting the organization's values and beliefs, and in developing the traits necessary for a successful business (Siehl & Martin, 1990). In this regard, in creating and implementing an organization's strategies, Schein (1983), one of the founders of the organizational culture concept, underlined the importance of cultural matters within organizations. He stated that "not only does culture limit the strategic options which are conceivable to an organization, but one cannot implement strategies if they run against powerful cultural assumptions" (Schein, 1990, p58).

Although this interest in the concept, from the academic standpoint, like the term "culture", there is no exact and standard definition of the term "organizational culture". Table 1 reviews, from the literature, some selected definitions of the concept "Organizational culture".

*Table 1. Some Selected Definitions of Organizational Culture in the Literature*

Source	Definition of organizational culture
Deal and Peterson (1999)	"The way we do things around here!".
Holt and Wigginton (2002)	The way that organizations promote the values that ensure cohesive actions between members of the teams

Hofstede (2011)	"The collective programming of the mind which distinguishes the members of one organization from another".
Wiegmann et al. (2004)	The values and beliefs of members of the organization, which are shared among them in the form of rituals, stories, myths, and language.
Schein (2010)	"A pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems" (p18).

In comparing and contrasting the definitions of the concept, according to Tharp (2009), there are three common and shared attributes between the diverse perspectives of sociologists, psychologists, anthropologists, and management scientists. The first is the concept of shared meaning; the second is the idea that organizational culture is socially produced and influenced by the environment and history. The third common attribute among definitions is that organizational culture is deep and exists at all levels with multiple symbolic and cognitive layers.

The literature also introduces the concept of organizational climate. This concept began to be used interchangeably by scholars in the 1990's, but recent decade literature confirmed a distinction between the two organizational concepts (Verbeke et al., 1998).

#### 2.2.2.2. Organizational Culture versus Organizational Climate

Organizational culture and climate are different but closely connected and feed off each other (Ostroff et al., 2013; Schein, 2000). Organizational culture research, as mentioned above, has its origin in anthropology, while climate is in psychology (Ostroff et al., 2013). Stolp and Smith (1995, p20) stated that while an organization's climate describes the people's shared perceptions in their group, culture involves both the people's feelings and what they believe and value in an organization. Simply stated, organizational culture refers to "the way we do things around here" in an organization,

while climate refers to the people's feelings about the organization's environment (Deal & Peterson, 1999). Both impact individuals' behaviors, but the climate is perceived as a narrower concept to explain these behaviors than culture because the climate is more about the immediate environment in organizations. In this regard, Schneider et al. (2002) associated the organizational climate with the employees' perceptions of their organization's policies, procedures, and practices. These perceptions have been studied mainly concerning morality output by associating each climate perception with the generated behavior from such a perception (Kozlowski & Doherty, 1989). It has also been discussed that individuals within an organization may perceive things differently, and consequently, they behave differently. Such behaviors would not necessarily be consistent with a desired organizational culture.

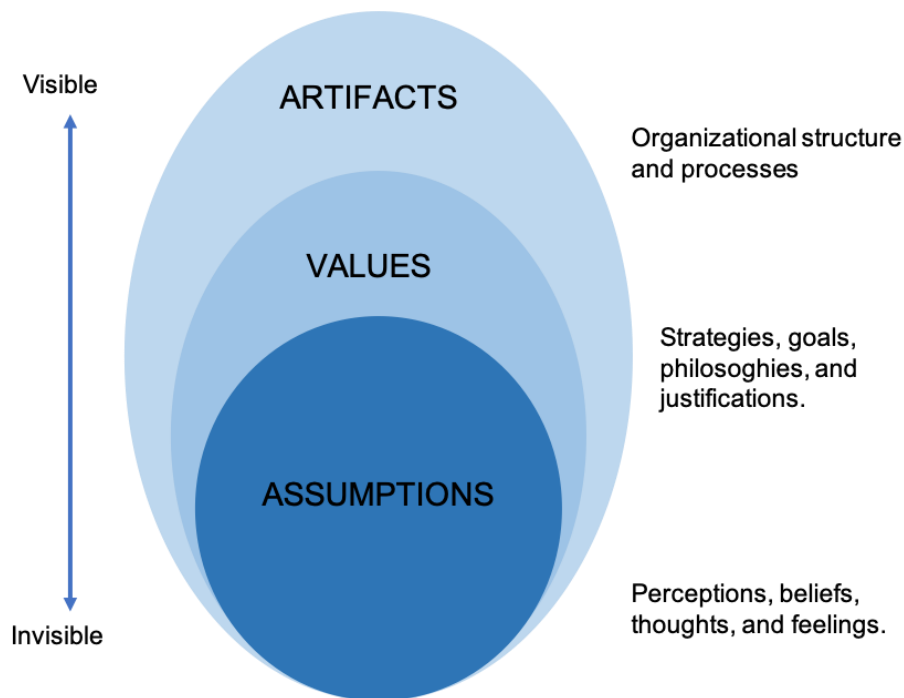
However, although organizational culture and climate have their roots in different disciplines and therefore have been approached from different perspectives, they are both concerned with the psychological aspects of organizations. Both concepts are based on the shared meanings and understanding of various aspects of the organizational setting (Ostroff et al., 2013). The two constructs are complementary and reveal overlapping differences in the psychological life of organizations (Schneider, 2000). Thus, studying culture and climate jointly is important because the two constructs together provide a broad context for understanding organizational behavior. As indicated by Schneider et al. (2011), the attributes associated with both climate and culture influence individuals and groups in organizations, including job satisfaction, turnover, safety, and job performance.

Indeed, several scholars have studied the two constructs and have proposed models to help understand both culture and climate in organizations. In this context, three cultural models are often used in the literature: Schein's cultural model, Hofstede's model of cultural dimensions, and Handy's cultural model. The following section presents an overview of the two first models (i.e., Schein and Hofstede's model).

### 2.2.3. Organizational Culture Models

#### 2.2.3.1. Layers of Organizational Culture- Schein's Model

Schein (1985), referred to as the godfather of the concept of organizational culture, developed a model that illuminates the existence of three different levels of culture in any organization simultaneously. To help explain and understand these layers, Schein (2004) has used the mental image of onion layers to describe organizational culture, as shown in Figure 2.



*Figure 2. The Schein Model's Layers of Organizational Culture*  
*Source: adapted from Schein (1980, 1985)*

**The external layer** comprises artifacts, which are the visible, tangible, and verbally identifiable components in organizations, such as safety posters, messages, documentations, safety reports, work procedures, and instructions. **The median layer** includes the espoused values and attitudes, which involves the written and verbal employer's statements and the employees' attitudes regarding safety. **At the core** of the organizational culture, there are the basic assumptions. Being implicit and invisible, but evident for the organization members, the basic assumptions consist of



the underlying and shared convictions between the organization members. Within organizations, these basic assumptions

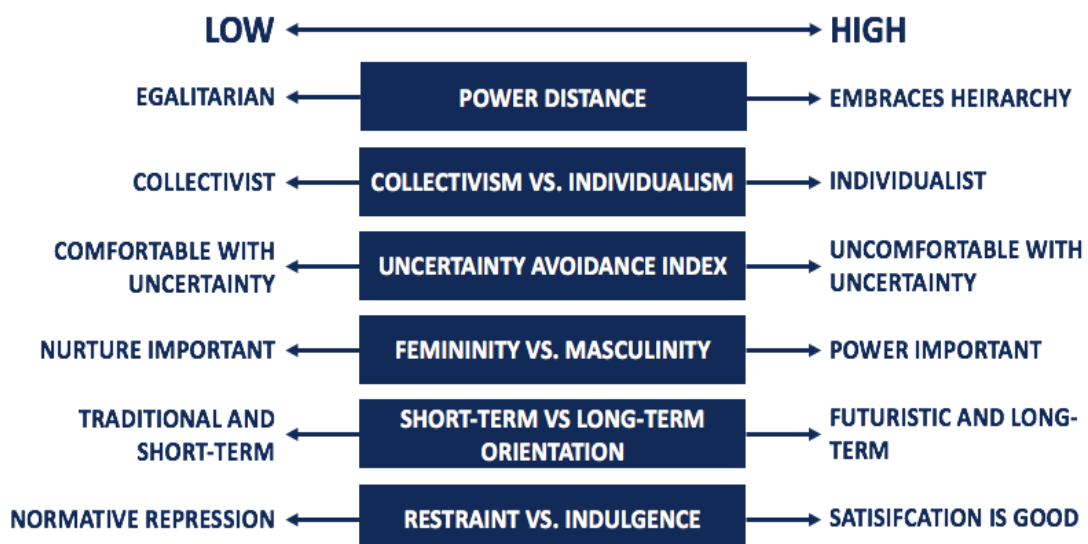
“could be about what is safe and what is not, about workplaces, their hazards, and housekeeping, about the time spent on safety, about whether certain people are likely to show risky behavior, about the extent to which people should take the initiative or await instruction and about whether it is acceptable to correct other people's unsafe behavior” (Guldenmund, 2010, p 49-50).

Located at the core of the organization's culture, unlike artifacts and espoused values, the basic assumptions are implicit and invisible; therefore, they cannot be identified easily and directly; they could, however, be discovered through the surrounding outer layers (Guldenmund, 2010). That means that the cultural core of any organization can merely be understood and construed by investigating and assessing the visible values, attitudes, and artifacts. In fact, it is the inconsistencies between artifacts and espoused values that disclose the hidden facet of the basic assumptions (Schein, 2004; Guldenmund, 2010). In line with this statement, Lieven et al. (2011) indicate that the espoused values in the interference with the related artifacts may, for instance, stress the leadership, prioritize working safely, open communication and participation, and promote training, individuals' responsibility and, near-miss reporting.

#### 2.2.3.2. Dimensions of Organizational Culture - Hofstede's Model

Geert Hofstede was amongst the first researchers to investigate the impact of national culture on organizational management practices. Several studies have utilized the dimensions introduced by this model to explore the differences of national cultures and their effects on organizational cultures, including the corporate safety culture e.g., Okolie and Okoye, (2012) and Noort et al. (2016). To understand the influence of national culture on organizations, Hofstede (1992) argued that national culture needs to be categorized in different dimensions. In this respect, Hofstede (1994), based on

studies conducted, from 1967 to 1973, in a multinational company (i.e., IBM-International Business Machines), proposed a culture model composed of four dimensions, namely power distance, collectivism versus individualism, uncertainty avoidance, and femininity versus masculinity. Later, in cooperation with Michael H. Bond and Michael Minkov, Hofstede included two additional dimensions: short-term versus long-term orientation and restraint versus indulgence. Currently, six (6) cultural dimensions can be identified in Hofstede's model of national culture (Figure 3 refers).



*Figure 3. National Culture Dimensions of Hofstede Model*  
*Sources: Corporate Finance Institute (2015)*

These includes:

- **Large versus small power distance (PDI):** The dimension depicts the extent to which the less powerful members in society or organizations expect and accept the unequal distribution of power (Hofstede, 2011).
- **Individualism versus collectivism (IDV):** It shows to what extent the individuals are integrated into the whole group. It looks, therefore, at cultural aspects like selfishness, coordination, harmony, and collectivism. Thus, this aspect is extremely fundamental in building a solid group such as the workplace teams (Hofstede, 2011).

- **Strong versus weak uncertainty avoidance (UAI):** This dimension depicts to what extent a society controls its members to avoid uncertainty. In an avoiding culture, strict social and behavioral codes, laws, and rules are mainly designed to minimize ambiguity. There is also a disapproval of deviant opinions and the promotion of full belief in the one and absolute truth as quoted "there can only be one truth, and we have it" (Hofstede, 2011, p10). However, a society with uncertainty accepting culture is more tolerant to different and unusual opinions; thus, it tends to have fewer rules (Furnham et al., 1995; Hofstede, 2011).
- **Masculinity versus femininity (MAS):** Masculine or feminine culture does not refer directly to the dominant gender in society. Instead, it relates to how masculine traits such as authority and assertiveness are preferred to female characteristics like the quality of life, personal relationships, and welfare (Jones, 2007).
- **Long term versus short term orientation (LTO):** The long-term pole involves values such as perseverance, thrift, arranging relationships according to status, and having a feeling of shame, while the short-term pole includes respecting tradition, protecting image, mutual social obligations, and personal stability (Hofstede, 2010).
- **Indulgence versus Restraint (IR):** According to Hofstede (2011), an indulgent society values the satisfaction of its members' needs and desires. It focuses more on people's happiness, well-being, and leisure time, and freedom and personal control are more respected. However, restrained society controls and curbs its members' satisfaction and aligns them with strict societal norms.

Indeed, Hofstede's model has contributed to a better conceptualization and understanding of organizational culture based on the national culture dimensions (Obeidat et al., 2012). However, some researchers predicted that the new technological modernization would likely clear the cultural differences and make societies more and more similar (Inglehart & Baker, 2000). Nonetheless, there is no proof that this will influence the variety of cultures; it may rather increase differences based on the fact that "existing value systems in societies cope with technological modernization in different ways", as stated by Kwork and Tadesse (2006).

Despite the contribution of these two models in the organizational culture literature, many researchers criticized them. They blamed the models in their cultural views to address organizational cultures (Williams et al., 1993). The Hofstede model, for instance, has been criticized by the fact that the model does not cover cultural diversity within the national cultures that might not be homogeneous. As stated by Williams et al. (1993), culture is not entirely homogeneous even in organizations. In other words, organizations can adopt more than one culture, especially complex organizations.

#### 2.2.4. Subculture in Organizations and Strength of Organizational Culture

It is commonly accepted that few organizations have compact and homogenous cultures (Schein, 2010). According to Reason (1997), culture is not a single construct in an organizational context but a combination and continuous interaction between multiple organizational subcultures (Antonsen, 2009; Schein 1991)). In practice, especially for big and multinational organizations, numerous factors can create subcultures, such as national, regional, sectoral, and professional cultures, political and economic situations, technology, and regulations. In this regard, Pidgeon (1998) stated that this fact of different subcultures might result in divergence in priorities and commitments. That leads, according to Pidgeon, to contradictions, instability, and inconsistency of values, attitudes, and behaviors among organization employees, which theoretically leads to negative consequences on safety outcomes. Moreover, such sub-cultures in one organization can overlap and disagree with each other. However, Pidgeon (1998) also indicated that different subcultures within an organization could result in a helpful phenomenon; this may initiate, for instance, diverse reactions and perspectives in response to unsafe situations.

In sum, it is hard to deny the existence of different subcultures in one single organization. However, the most important is to ensure coexistence between these subcultures. The overall organizational culture should absorb the subcultures' negative and positive influences to build an integrated strong culture (Chatman, 2003). Furthermore, the organizational culture, whether there are subcultures or not, should

enable the organization to perform and adapt to new changes (Wahyuningsih et al., 2019). It must be able to design the behaviors within the organization that lead to its performance outcomes (Joseph & Kibera, 2019). In addition, organizational culture should provide a sense of belonging to individuals, contributing to their commitment toward achieving the organizational goals and objectives and their social stability; therefore, their behaviors can be effectively shaped and generated positively (Wiegmann et al., 2004).

However, a number of factors can influence this role of organizational culture. In practice, corporate culture is influenced by how the company is structured and how its leaders set it up for success (Abrell-Vogel & Rowold, 2014). Furthermore, making it a behavioral issue and promoting teamwork and leadership would influence the culture of any organization (Bratton et al., 2007). National and societal culture is another factor affecting organizational culture; indeed, how people behave is strongly linked to society's norms (Buchanan & Huczynski, 2010). Therefore, because of the influence of many factors, some organizational cultures could be stronger than others. This power of an organization's culture can be determined, as indicated by Lubis and Hanum, (2020), by looking into the living of core values by its members and the clarity of regulation. The more the members accept and live the organization's core values, the greater the members' commitment contributes to the strength of the organizational culture and then to the organization's performance.

There are several strengths of organizational cultures. For example, mature organizational culture is characterized by the stability of its members and their ability to cooperate and instill deep value (Schein, 2010). A strong culture is another kind of strength of organizational culture. It refers to the one that supports high ethical standards (Wahyuningsih et al., 2019) and provides clarity about behavior that must be adopted and implemented by its members (Purnama, 2013). Moreover, this type of organizational culture is more consistent in applying the complete set of the organization's values and beliefs. It is perceived as a powerful medium for communicating and sharing the desired behavior between members, especially for the new organization members, as soon as possible through socialization with old

members. More importantly, it makes people think to achieve common organizational goals and objectives rather than just individual interests (Shafritz et al., 2015; O'Reilly et al., 2014).

As a result, several functions and benefits can be drawn from a strong organizational culture. It gives an organization's members an identity that differentiates them from other organizations. It increases cooperation and makes the work environment comfortable. Furthermore, strong culture shapes the desired behavior by helping the organization members become more aware of their environment (Lubis & Hanum, 2020).

Although such a strong culture may help ensure members' identity, commitment, and motivation, it has been argued that the relevance of a strong culture differs, to some extent, from one organization to another (Baker, 2002). For instance, a profit-oriented organization is unlikely to focus more on the organizational culture aspects than the safety-oriented organizations, including nuclear, aviation, and maritime industries.

### 2.3. Overview of Safety Culture

Safety culture is intrinsically linked to the concept of organizational culture and has attracted interest in a wide range of industries (Donald & Young, 1996; Choudhry et al., 2007)). Therefore, most of the conceptual definitions of safety culture have been derived from organizational culture (Cox & Flin, 1998). Furthermore, as stated by Guldenmund, (2000), safety culture is encapsulated in the organizational culture's characteristics that influence the individuals' attitudes and behaviors related to the control and elimination of the hazard.

#### 2.3.1. Background and Definitions

The concept of 'safety culture' has been first used after the Chernobyl disaster in 1986 (Mearns & Flin, 1999). The International Nuclear Safety Advisory Group of the International Atomic Energy Agency (IAEA), in the investigation report of the Chernobyl disaster, identified "poor safety culture" as one of the causal factors leading

to the worst accident of nuclear power plants in history (Mearns & Flin, 1999; Cox & Flin, 1998). In the following years, in some tragic accidents, such as the King's Cross underground fire in London in 1987 and the explosion of the oil platform "Piper Alpha" in 1988, cultural aspects were also pinpointed as contributing factors to the accidents (Weigmann et al., 2002; Antonsen, 2009). Since then, particularly in high-risk industries, the concept "safety culture" has been largely used in various safety research, acknowledging, therefore, the importance of the human factor and the soft aspect of the organization (i.e., cultural part) (Antonsen, 2009).

Similar to the term's "culture" and "organizational culture", although "safety culture" has been extensively studied for many years, there is no standard definition of the concept (Guldenmund, 2000; Bisbey et al., 2021). In the first appearance of the concept, the IAEA defines safety culture as "the assembly of characteristics and attitudes in organizations and individuals, which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance" (IAEA, 1991, p.1). As Cooper (2000) indicated, this definition stresses that safety culture is not only related to safety attitudes; instead, it is an important performance indicator of safety management systems. The definition underlines the aspect of good management, not only good behaviors.

In the literature, the most cited and used safety culture definition is the one detailed by the UK Health and Safety Commission (HSC) (Cox & Flin, 1998). It has endorsed the IAEA's definition of safety culture and provided some characteristics of a positive safety culture. It defines the safety culture as follows: "the product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of an organization's health and safety management" (HSC, 1993, p.23). In line with this definition, Cox and Cox (1991) define safety culture as "the attitudes, beliefs, perceptions and the values employees have in common in regards to safety.". The same view was offered by Pidgeon (1991). He argued that safety culture could be seen as a constructed system of meanings within a group, by which workers understand the hazards associated with their work. In sum, although the literature has offered several

definitions of safety culture, almost all of them encapsulate the shared beliefs, values, and attitudes by group members. In other words, it is commonly agreed that, at the individual level, safe or unsafe behaviors are partly driven by the individual's beliefs, values, and attitudes (Muthuyadav et al., 2015).

In practice, the term "safety culture" refers to how an organization manages safety and how people share beliefs and attitudes that produce behavior and guide decision-making (Casey et al., 2017). Thus, two broad elements of safety culture can be identified. While the first element includes organizational practices, procedures, and policies to manage safety, the second element covers concepts such as beliefs, attitudes, values, and norms shared in an organization. In other words, organizational safety culture is, on the one hand, something that an organization designs to manage safety, i.e., policies, practices and procedures; on the other hand, it has something that people share, i.e., attitudes, beliefs, values, and norms. The second element is referred to in the academic literature as "safety climate" (Neal et al., 2000).

### 2.3.2. Safety Culture versus Safety Climate

The relationship between the two concepts "safety climate" and "safety culture" has been exhaustively documented (Guldenmund 2000; Cox and Flin 1998; Antonsen 2009; Guldenmund, 2010). Originated from a psychological approach towards safety culture, the term "safety climate" traces back to a study conducted by Dov Zohar (1980), and since then, several studies and papers have been developed (Flin et al., 2000; Guldenmund, 2010; Seo et al., 2004).

Although the two terms "safety culture" and "safety climate" have been used interchangeably, they are not the same (Lieven et al., 2011). Flin et al. (2000) indicated that safety climate could be viewed as a superficial and transitory snapshot of organizational safety culture. Simply stated by Cox and Flin (1998), using a metaphor: safety culture within an organization can be perceived as an organization's personality, whereas safety climate is an organization's mood. Thus, like organizational culture versus climate, safety culture is assumed to be a relatively stable construct and resilient to change in the face of immediate and transient issues than climate (Yule, 2003).



Regarding the focus of safety climate, Zohar (2010) emphasizes three targets in any organization of safety climate. It should look first at the way employees prioritize safety in competing situations. Second, it should correct the gap between how top management prioritizes safety and how safety is compromised in practice under operational pressures and demands. Finally, the safety climate should look at the potential conflicts between how the top management set up policies and procedures and how these are put in practice at the workplaces and lower organizational levels. Therefore, as stated by Fogarty and Shaw (2010), the safety climate is one of the essential dimensions of safety culture and an effective tool to measure safety performance in organizations.

### 2.3.3. Safety culture, Safety Climate, and Safety Performance

The issue of the safety culture approach is to find possible links between the organization's safety culture and safety performance at both the corporate and lower levels (Smith & Wadsworth, 2009). However, undoubtedly, enhancing safety culture amongst workers would positively influence their behaviors, compliance, and participation in performing their tasks, leading to a higher level of safety in an organization (Guldenmund, 2010). Thus, Yule and Flin (2007) stated that safety culture represents an important leading performance indicator that can provide insight into safety performance and prevent accidents. Similarly, safety climate is considered and confirmed by many studies as being an important indicator and predictor for safety performance across industries and can form a basis for a proactive approach toward an organization's safety performance (Antonsen, 2009; Griffin & Curcuruto, 2016). In this context, Fang and Wu (2013) stated that a safety climate could be considered as a measurable tool reflecting organizational safety culture. By analyzing the safety climate surveys, in fact, it may be possible to identify the relationships between the different safety culture dimensions within an organization and understand how it can contribute to the overall outcome of its safety performance (Cooper & Phillips, 2004).

Therefore, it can be concluded that safety climate and culture measurements are highly correlated and inter-connected (Casey et al., 2017). Thus, for practical

purposes, the term "safety culture" is used in this research to cover both climate and culture. This is due to the fact that safety culture is broader than the term safety climate; furthermore, in the maritime context, the term safety culture is more widely recognized than safety climate.

#### 2.3.4. Assessing and Improving Safety Culture

Based on the quoted text from Kelvin, "*you can't improve what you can't measure*", the continuous measurement of safety management performance is key (Berg, 2013). In this regard, to determine whether or not change is necessary to improve management of safety in organizations, safety culture is widely perceived as an effective predictor and indicator of safety performance (Berge, 2013; Yule & Flin, 2007). Therefore, academic researchers have also extensively studied the topic associated with safety culture measurement. Several philosophies, forms, and models of safety culture measurement consequently have been developed. However, the literature still recognizes that the goals of safety culture assessment still tend to be more improvement-oriented. As well as there is neither common method of assessing safety culture across domains or even within a single domain, nor standardized safety culture dimensions to consider (Cole et al., 2013, p31). Table 2 reviews some surveys that have been used in the previous safety culture surveys in aviation and shipping industries and their related dimensions.

**Table 2.** *Some Safety Culture Dimensions Used in Shipping and Aviation Industries.*  
*Source: Adapted from Jung (2021)*

Division	Study	Dimensions
Aviation	Wang and Sun (2012)	Priority- standardizing- flexible- learning- teamwork- reporting- just culture.
	Song (2014)	Skill- attitude- learning- communication- resource management- organizational structure- management of change.

Shipping	Bhattacharya (2015)	Safety- organization support- resource availability- work environment- job demands- just culture- safety compliance
	ABS (2014)	Communication- empowerment- feedback- mutual trust- problem identification- promotion of safety- responsiveness- safety awareness.

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In contrasting the surveys, safety culture dimensions differ between industries and even in the same industry, as stated by Cole et al. (2013, p31). In fact, depending on the purpose of the research, an appropriate selection of the safety dimensions and the related indicators is key for the success and failure of the safety culture assessment (Flin et al., 2000).

## 2.4. Overview of Safety Culture in the Maritime Context

### 2.4.1. Human Factor and Maritime Accidents

In recent years, the shipping industry has witnessed catastrophic accidents, such as *Costa Concordia*, *Norman Atlantic*, and *Herald of Free Enterprise*. Until to date, a high number of maritime accidents, including fire, collision, grounding, and capsize still occur (Balisampang et al., 2018). According to the AGCS (2019), there were still 2698 accidents in 2018 globally, which makes the safety of shipping a persistent thorny issue that needs urgent actions and additional efforts for further improvement of safety within the sector (Batalden & Sydnese, 2014; Berg, 2013). In particular, human factor error is still revealed as the first contributor factor in the majority of catastrophic accidents and is blamed in 80 to 85% of maritime accidents (Hasanspahić et al., 2021).

However, in looking deeply into the causes of accidents, while major causes of these accidents were connected to human errors, they were attributable to organizational factors. Specifically, safety policies, communication, training, incidents reporting, and learning systems, among others, played an important role in shaping behaviors and directly or indirectly produced human errors (Lützhöft et al., 2011). As

stated by Octenal (2011), human error is not an explanation for the cause of accidents but itself needs further explanation.

#### 2.4.2. ISM Code and Safety Culture in Shipping

In order to improve maritime safety by impacting the way ships are managed and operated, the IMO has introduced the ISM Code. The ISM Code provides "an international standard for the safe management and operation of ships". In fact, an effective application of the ISM Code is assumed to result in a shift from a culture of unthinking (i.e., compliance) towards a culture of thinking and self-regulation of safety (i.e., safety culture) (IMO, 2019). Moreover, effective implementation of the ISM Code should support and encourage the adoption of a proactive approach toward safety through the development of an appropriate safety culture.

In other words, prioritizing safety - from the top to the bottom - at the organizational level and on-board ships has been regarded as key to ensure the safe operations of ships (IMO, 2019). Since then, safety culture has been widely recognized as one of the most important aspects of maritime safety (Anderson, 2015; Oltedal, 2011). Indeed, the ISM Code provided a regulatory framework to support the development of such a culture through the establishment of effective Safety Management Systems (SMSs) by the shipping companies. The implementation of such SMSs has resulted in a positive impact in promoting safety culture awareness in shipping, as confirmed by findings of a study conducted by Jung (2021). The study compared the Korean vessels engaged in international voyages (i.e., ISM Code is implemented) and domestic Korean vessels (i.e., the ISM code is not implemented). The findings affirmed a strong correlation between the effectiveness of the ISM Code implementation and safety culture awareness amongst seafarers.

However, the SMS in many shipping companies has been described as having a rule-oriented character, resulting in an increasing bureaucracy, and implemented on a broad basis (Teperi et al., 2019). Thus, as stated by Celik (2009), there is a rising need for organizational safety policy to support safety culture in shipping organizations. Specifically, for the SMS in shipping, as a systematic approach to safety

onboard ships, to overcome the shortcomings and work efficiently, the organizational culture needs to be at the level where it can support the SMS and enable it to grow and improve continuously (Grote & Künzler, 2000).

#### 2.4.3. Organizational and Psychological Factors and Safety Culture In Shipping

As one of the safety-critical organizations, maritime safety management depends fundamentally on the beliefs and assumptions regarding organizational behavior and safety of both the management and personnel (Reiman et al., 2015; Shroff, 2017). In fact, in practice, a ship's safety depends strongly on organizational and individual interactions and their behaviors and commitment toward safety. Therefore, any organizational factor that affects seafarers while serving onboard ships may affect their behaviors and commitments toward safety and, therefore, may deviate from the entire ship's safety level.

Furthermore, by impacting on the psychological side, the organizational factors have shown a great influence on the employees' motivation, cognitive processing, and striving for success and result in a good safety culture level (Nurcholis & Qurniawati, 2020; Ang-Jun et al., 2018; Cavus & Gokcen, 2015). In addition, based on the well-known expression "happy ship", it was indicated that crew motivation and job satisfaction are considered fundamental elements in shipping and affect safety perceptions (Bergheim et al., 2015). These conditions, as quoted in the literature, "feeling good and functioning well", refers to psychological well-being and is described as a critical dimension that influences the safety and efficiency of work within safety-critical organizations, such as the ship's environment (Alagaraja, 2020; der Kinderen et al., 2020).

Therefore, it can be seen that the organizational culture in managing safety is key for the success and failure of safety in shipping. That includes, for instance, the organizational commitment to safety and its safety prioritization, which may affect the employees' commitment toward safety (Li et al., 2021; Horwitz, 2017). However, as discussed in the previous section, organizational culture is not always a homogeneous and compact culture. Particularly, because of the global nature of shipping, the

existence of several subcultures in one single maritime company is unlikely to be avoided. That means different priorities and commitments toward safety can be identified. Therefore, how do these subcultures affect the overall organizational safety culture?

#### 2.4.4. Organizational Subcultures and Safety Culture in the Maritime Context

The organizational safety culture literature does not seem to provide a clear answer about the impact of the existence of different subcultures in one organization. In addition, it does not provide a clear explanation about the mechanism by which this fact affects safety and safety culture in organizations. In this concern, Pidgeon and O'Leary (2000) argued that subculture is not necessarily negative; it may indeed contribute to "safety blind spots". Similarly, Boissier and Chatman (2003, p90) stated that subculture could develop within a single corporate safety culture without weakening it. On the contrary, other scholars, e.g., Røllenhagen et al. (2013) support the need for cultural integration in organizations as a way to ensure organizational reliability and safety.

#### 2.5. Conclusion

The literature commonly agreed on the importance of safety culture in achieving the desired safety level in organizations. It furthermore emphasizes the central and the mediating role of the organizational culture to achieve this goal. The organizational culture should stand as the umbrella that brings together the organization's members under common safety goals. However, this will not be achieved merely through self-commitment toward safety from both managerial and operational personnel. In particular, organizational management should pay more attention to their practices, including their safety prioritization and commitment.

Maritime shipping as a global industry is frequently subject to different management practices. For instance, one shipping company is sometimes operated by different entities with different management practices, resulting in the unavoidable existence of different subcultures. Accordingly, each subculture has its own priority

and commitment. These facts will raise the question: How do these subcultures affect safety culture in organizations?

The literature does not seem, as mentioned above, to provide a clear answer about the impact of subcultures on safety culture. This gap indicates the need for the current research. For this purpose, the study takes a case study of a shipping company, in Algeria, engaged in both international and domestic shipping activities. By assessing and comparing safety culture of the two-divisions (i.e., ocean-going and domestic ships) of the same company, the study investigates the existence of different subcultures of safety as a result of the fact of differing the organizational cultures. In particular, the study looks for the way by which the organization commitment toward prioritizing safety and other organizational factors contribute to creating such safety subcultures between these two divisions, and consequently influence the shipboard involvement in safety and the overall safety culture of ocean-going and domestic ships. The next Chapter provides the methodology employed to conduct the current research.

## **CHAPTER 3: RESEARCH METHODOLOGY**

### **3.1. Introduction**

According to Kothari (2004, p8), “A research methodology is a way to systematically solve the research problem” .The related science provides various methodologies to conduct research. However, the choice of an appropriate method depends mainly on the method’s ability to achieve the aim and objectives of the research (Gray, 2013). In this chapter the proposed methodology for the research is discussed, including (1) the research strategy, (2) ethical issues, (3) data collection, (4) data analysis, (5) validity and reliability, and finally, the limitation of this research.

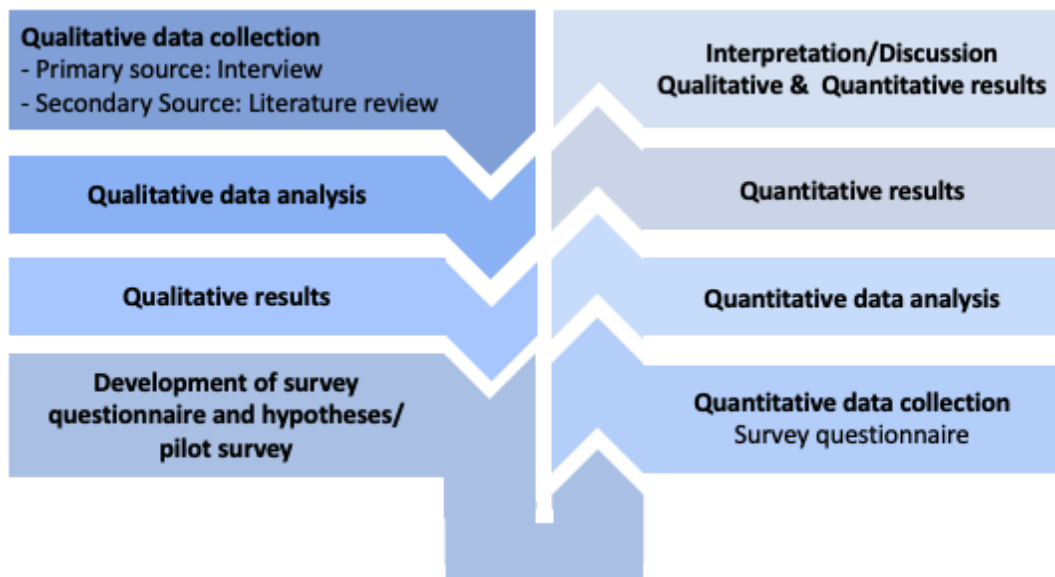
### **3.2. Research Strategy**

The study investigated the existence of different subcultures of safety as a result of an existence of different organizational subcultures in the same shipping company. For this purpose, the research took as a case study of maritime companies, in Algeria, engaging simultaneously in international and domestic shipping activities. In particular, these companies apply most of the international Conventions onboard their domestic ships, especially, the ones related to seafarers’ qualifications (i.e., STCW) and safety management, i.e., the ISM Code. However, the organization’s management of safety between the two shipping divisions were assumed and demonstrated in the research to be different.

To conduct this research, an “exploratory mixed method” was applied. A qualitative exploratory survey, consisting of semi-structured personal interviews, was first conducted to broadly investigate the differences between the two companies’ divisions regarding the shipboard and the companies’ organizational management, preferences, practices, and attitudes related to safety. This exploratory part, in



particular, aimed to identify the critical variables and dimensions of safety culture to be explored further in the research. Indeed, the study, in addition to the related safety culture literature has explored the findings of the exploratory survey to help develop a quantitative safety culture questionnaire. This measurement tool was perceived, first, to be able to assess safety culture with regard to the selected dimensions, and second, to be able to underline the factors that make the differences between the two related organizational cultures in terms of managing safety. Subsequently, the data collected, either qualitatively and quantitatively, served addressing the research aim and objectives, following the research design path explained in Figure 4.



*Figure 4. Research Design – Exploratory Mixed Method*  
Source: the researcher

### 3.3. Ethical Considerations

Ethical considerations were followed in this study due to the involvement of people as participants in personal interviews and questionnaires. The approval of the survey questionnaire and interviews required rigorous review by the WMU Research Ethics Committee to ensure the highest ethical standards adherence. In addition, along with protecting the participants' rights and privacy, the research considered factors such as confidentiality, anonymity, data protection, and the ability to withdraw from the study. Furthermore, the participants' contributions were entirely voluntary, and

there were no fees associated with their involvement in the study. Finally, no changes or additions to the received data were made, and all material was deleted after the submission of the dissertation. The WMU Research Ethics Committee Protocol is attached in [Appendix A: WMU Research Ethics Committee Protocol](#).

### 3.4. Data Collection

The process of collecting data by interviews started on 28 May 2021 and by survey questionnaire on 25 June. The researcher finalized the data collection by the end of July. A detailed discussion on the data collection through interviews and questionnaire survey ensues.

#### 3.4.1. Qualitative Method- Personal Interview

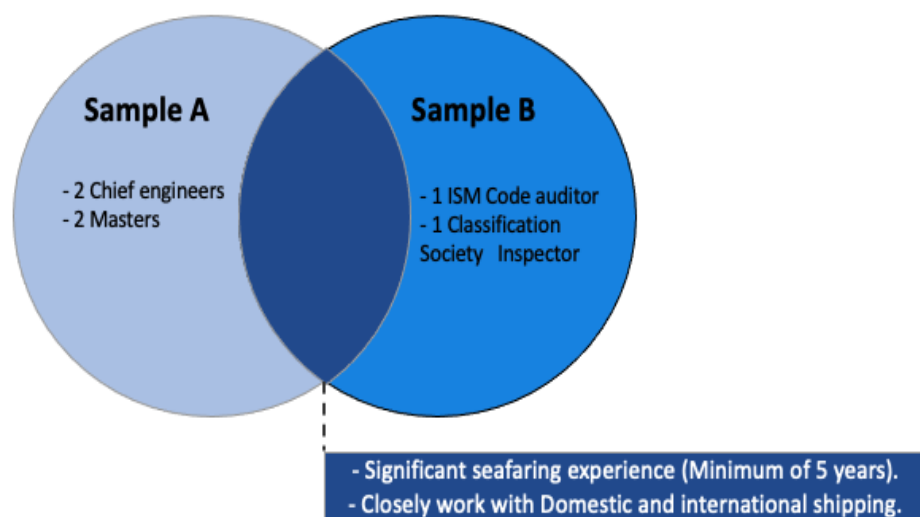
The current study utilized both primary and secondary qualitative sources of data collection. Primarily sources included semi-structured interviews. Secondary sources included previous studies conducted in shipping and other industries such as aviation and nuclear power industry, and included also international publications, books, and international journals.

The researcher conducted semi-structured interviews to get insights regarding different aspects associated with safety culture onboard ships engaging in international and domestic voyages. Participants in these interviews were regarded as experts in the field by experience; therefore, when given this opportunity to speak freely, they provided precious information related to the research. The interviews were comprised of both open-ended and direct questions (See Appendix C: Personal Interviews Appendix B : Safety Culture Survey Questionnaire). In addition to the ethical consideration, the careful and consistent phrasing of questions, and the selection of experienced interviewees aimed to obtain maximum benefits and collection of data that may address as appropriate as possible the research questions.

The research interviews involved a careful selection of six relevant participants, including two Chief Engineers, two Masters, classification society inspector, and ISM Code auditor (see [section 3.4.1](#)). The 4 Chief Engineers and

Masters have considerable experience in serving in both international and domestic shipping companies. The two other participants have a seafaring background and closely work with both international and domestic ships' seafarers.

After selecting the relevant participants, the research interview process started by contacting the chosen interviewees via email or phone call to explain the purpose of the research and ask for their participation in the study. Those who accepted to contribute were provided further aspects regarding the investigation and ethical issues and subsequently, the interview date was agreed on. The interviews were conducted in French and Arabic, which are the two spoken languages in Algeria and then translated by the researcher to English.



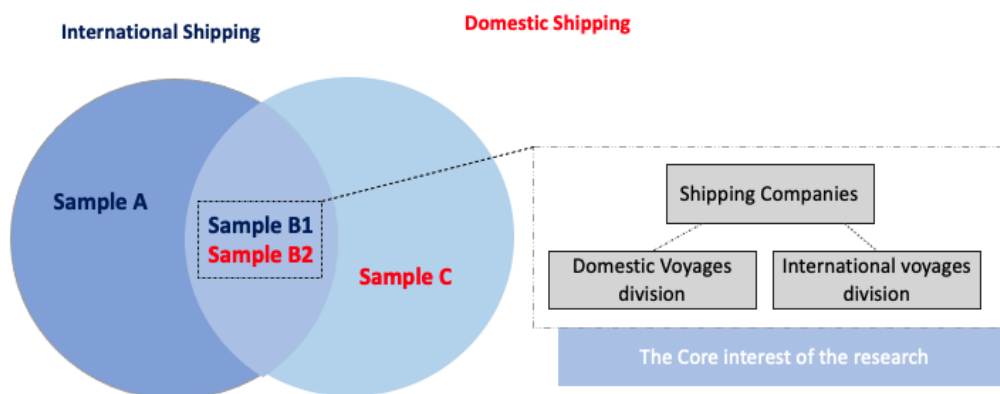
*Figure 5. Composition of the Study Interviews' Sample*  
Source: Researcher

#### 3.4.2. Quantitative Method - Survey Questionnaire

In this part, the study uses only a primary source, consisting of a quantitative survey questionnaire. The survey targeted Algerian seafarers working on board ships belonging to shipping companies operating both ocean-going and domestic ships. However, because of the difficulty to directly target the sample of the interest by an online survey, the questionnaire was first distributed to the whole seafaring population in Algeria. Then, the researcher filtered the targeted sample in the data analysis process.

using the background information. Accordingly, the survey population consisted of four samples (see [Figure 6](#)):

- Sample A: Seafarers employed by shipping companies operating only ocean-going ships.
- Sample B1: Seafarers working onboard ocean-going ships belonging to shipping companies operating both of domestic and ocean-going ships.
- Sample B2: Seafarers working onboard domestic ships belonging to shipping companies operating both of domestic and ocean-going ships.
- Sample C: Seafarers employed by shipping companies operating only domestic ships.



*Figure 6. The Targeted Samples of Seafarers by the Survey Questionnaire*  
*Source: Researcher*

The questionnaire was developed based on: (1) the literature review and previous studies in shipping and other industries; and (2) the initial exploratory study. In fact, in developing this questionnaire, items from previous surveys as well as new ones were used. Items selected from previously validated questionnaires were rephrased in such a way all seafarers, whatever their ranks, can understand their meaning. The study selected some items that were previously used in different studies and standardized surveys, such as: Safety Climate questionnaire -NOSCQ-50; Safety

attitudes questionnaire-SAQ; Zohar (2000, 2003); and the Safety Culture Questionnaire used in a study conducted by (Oltedal, 2011). The first draft of the survey questionnaire consisted of 94 items covering several aspects of safety culture on board ships. With the help of the exploratory study analysis, the researcher reduced the number of items, where some were removed, and new ones were added. The final draft of the questionnaire was composed of 46 items belonging to six (3) main sections in addition to the background information section (Appendix B : Safety Culture Survey Questionnaires).

The questionnaire was developed and administered to quantitatively collect data from seafarers. It was designed to collect perceptions regarding different aspects related to safety culture. Thus, the questionnaire consisted of a collection of statements, e.g., “Minor incidents are not reported in writing on my vessel.”, which required the participants to answer by giving their agreement according to a Likert scale ranging from “strongly disagree” to “strongly agree”. In the pilot survey, a 7-point Likert scale was used (Strongly disagree- Disagree- Slightly agree - Agree- Neutral-Agree-Slightly agree- Strongly agree). Based on the pilot study feedbacks, and given that the questionnaire used an online software, the researcher shortened the length of question phrases. The Likert scale length was also reduced to 5 points (i.e., Strongly disagree- Disagree- Neutral- Agree- Strongly agree).

The original version of the questionnaire was in English. After receiving approval from the WMU Research Ethics Committee, the questionnaire was translated from English to French and Arabic. A forward-backwards translation method was used to avoid any significant divergence in the meaning of items between the three languages. The translation was performed by independent translators from Algeria and France, with knowledge of English, and French and/ or Arabic. The final two questionnaires (i.e., Arabic and French questionnaire versions) were compared to the original version by the researcher and an English professor in Algeria.

### 3.5. Data Analysis

The primary purpose of the personal interviews phase was to serve as an exploratory survey. It was intended to help build the questionnaire sections, develop hypotheses, and assist in the discussion part. The research interviews to meet the assigned role was guided by two research questions:

RQ1: What are the key elements that differentiate safety culture between international and domestic shipping?

RQ2: In what way does a shipping company management contribute to a difference in safety culture between its ships' divisions of international and domestic shipping activities?

The interview data were analyzed using content analysis and manual coding. The data collected by the quantitative questionnaire was analyzed using SPSS.

### 3.6. Reliability and validity

The mixed-method used in this research provided deep insights and information regarding the aim and the objectives of the research. The semi-structured interview questions were prepared carefully concerning both content and structure and were validated by a professor with extensive experience and knowledge in the maritime sector.

For the quantitative part, owing to the fact that the questionnaire composition was a mix of old and new items which no previous study had examined for their reliability or validity, the reliability and validity evaluation of the questionnaire was performed in the data analysis. Furthermore, the inclusion of relevant stakeholders for the study such as classification society inspector, ISM Code auditor, Chief Engineers and Masters, as well as a large number of seafarers (a total number of 549 seafarers) lead to achieving a valid and reliable research outcome.

### 3.7. Limitations

There are numerous aspects and indicators for assessing safety culture. However, for the research objectives and the limitation of the allocated time, many

elements were omitted, such as employees' empowerment, leadership empowerment, and reward system.

The seafarers targeted by the questionnaire survey who meet the core interest of the study were only from Algeria; the findings can be said, therefore, not entirely representing the viewpoints of the worldwide maritime population.

Last and not least, this safety culture questionnaire, as a tool of assessment, was based on collecting self-reported perceptions, opinions, beliefs, feelings and practices. Unfortunately, such self-reporting can deviate from reality. Therefore, additional instruments to correct this deviation and examine what is in place may be necessary, including audits and local observations.

## CHAPTER 4: DATA ANALYSIS

The previous chapters provided the theoretical framework and the suggested methodology to conduct the research. This chapter will discuss the results of the data analysis. The first section consists of the qualitative data analysis, and the second section will analyze the quantitative data.

### 4.1. Qualitative Data Analysis

The qualitative survey was primarily intended to explore the topic of interest and help developing the measurement tool and formulate possible hypotheses. Seven interviews with maritime experts, as described in [section 3.4.1](#), were conducted and garnered in depth information regarding the key differences between ocean-going and domestic ships in various aspects related to safety culture. Each recorded interview took an approximative time between 45 to 60 minutes. Then, the researcher analyzed the interviews findings by categorizing the data and identifying themes, which assisted in developing the measurement tool and one main hypothesis.

#### 4.1.1. Analysis of the Interviews

According to Creswell (2009), qualitative data analysis consists of several steps. Transcribing the interviews was the first step. It was followed by reading the transcripts many times along with listening to the recordings to ensure the accuracy of the transcription and all the information given by participants were correctly captured. In particular, the interviews transcripts were organized in sections to help categorizing data. The transcripts were, then, provided to the participant to check and give their final approval. The second step was categorizing the data. As indicated by Creswell and Plano-Clark (2007), “categorizing is the process of grouping evidence and labeling ideas so that they reflect increasingly broader perspectives” (p.123). The third step was



developing themes based on the categories proposed. In fact, this step relies also on reading the transcripts many times to identify interview themes. The last step in analyzing the interviews was interpreting the data through the examination of the categories and labeling the interview themes.

#### 4.1.2. Qualitative Results

The samples of the interviewees, as described in [section 3.4.1](#), were carefully selected to provide as much as possible relevant information, relative to safety culture onboard ocean-going versus domestic ships. The selected 2 Masters and 2 Chief engineers have an abundant experience in working onboard both types of ships in their company. In addition, an ISM Code auditor and a classification society inspector were also selected based on the fact that they closely work with these two types of ships and their crew. In total, six interviews were conducted and then analyzed. The researcher identified four (4) categories, including fourteen (16) themes related to the topic of interest. The four categories are: the organizational safety management, shipboard safety climate, job satisfaction, and pressure and stress on board ships. The description of the three categories and their associated themes are as follows:

##### **Category 1: *Organizational safety Management***

This category arose from interviewees discussing how the organization manages safety of their ocean-going and domestic ships. Two themes were extracted from this category: (1) *prioritizing safety over commercial operation* and (2) *proactive approach in improving safety*. This second theme relates to how the shore side in the company collaborates with the shipboard and provides support to improve safety before accidents occur.

##### **Category 2: *Shipboard safety climate***

This category involved 11 themes relative to the environment and the working conditions onboard ships that positively or negatively impact safety. The ten themes are: (1) *effectiveness of the SMS's procedures*, (2) *adequacy of safety training*, (3) *adequacy of documentation*, (4) *adequacy of safe manning level*, (5) *Master and*

*immediate superiors' prioritization of safety, (6) teamwork environment, (7) safety communication, (8) reporting system, (9) tradeoff between work efficiency and safety, (10) fatigue, and (11) crew safety behavior.*

#### **Category 4: Job Satisfaction**

This category involved one theme: *Crew Job Satisfaction*. It referred to what extent seafarers are satisfied with their job, salary, career, company and the working conditions on board ships. This latter, crew job satisfaction, was considered as an influential element on safety culture in this study, based on previous studies in various domain such as the health care. In fact, in this latter, it occupies a whole section in the related Safety Attitude Questionnaire (SAQ) that was used to assess safety culture.

#### **Category 3: Pressure and Stress on Board Ships**

This category involved two themes consisting of (1) *external safety supervision*, and (1) *other stressors on board ships*. The external safety supervisions referred to in the interviews were related to port and flag State controls, external audits and other safety inspections carried out by external entities. the other stressors involved different factors that introduces stress to seafarers such as working conditions, health issues, and the seafaring job itself.

#### **4.1.3. Development of Main Hypothesis**

Based on the interviews analysis, it can be witnessed that there was common agreement that safety culture of ocean-going and domestic ships belonging to the same company and operating by interchanging crews is different in many aspects. In other words, the same seafarers under the same regulations behave differently when exposed to different organizational management of safety. Therefore, to felicitate addressing the research aim, a hypothesis H1 was formulated as follows:

**Hypothesis (H1):** *“The organizational subculture affects safety culture and results in respective subcultures of safety in the same organization, even with the same employees with the same qualifications.”*

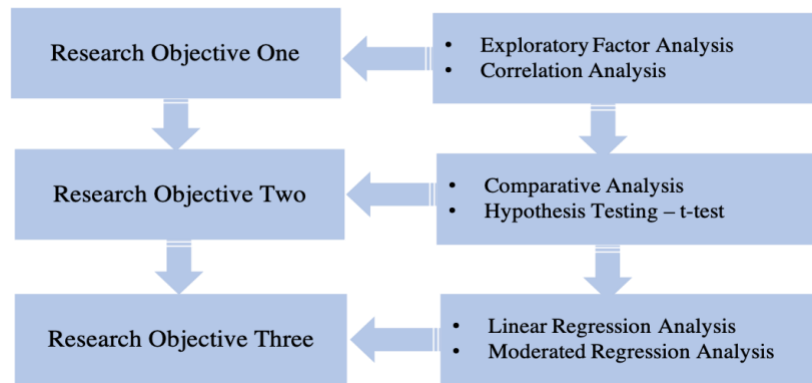
Further in the hypothesis testing, hypothesis H1 was broken-down to height sub-hypotheses for statistical reasons (see [section 4.3.3](#)).

#### 4.1.4. Development of the Survey Questionnaire

As mentioned above, the qualitative part of the mixed method provided exploratory data. In particular, the data helped in constructing the study safety culture measurement tool. Based on the detail of the themes, several aspects connected to safety culture to be assessed by the questionnaire were first suggested, among others communication, safety prioritization, documentation, training, safety participation, safety compliance, safety and management system. Then, by exploiting previous safety culture assessment studies, some suggested aspects were found replicated in different studies' measurement tools, among others the Safety Attitudes Questionnaire (SAQ), The Nordic Occupational Safety Climate Questionnaire (NOSCQ-50), and a study conducted in shipping by Olstedal (2011). Therefore, to preserve the psychometric priorities of the questionnaire's items, these replicated items were taken and adapted to the maritime context. Finally, a safety culture survey questionnaire was constructed with the aim to assess safety culture and disclose differences between ocean-going and domestic ships. In the quantitative data analysis, the questionnaire validity and reliability were assessed. [Appendix D: The Construction of the Survey Questionnaire](#) presents the questionnaire's items and their link to the interviews analysis' themes.

#### 4.2. Quantitative Data Analysis

The quantitative data analysis consists of two parts. The first part was the preliminary analysis, including data collection and preparation for analysis, demographic characteristics, and reliability and validity. The second part of the analysis analyzed the results and tested the different hypotheses. In particular, when analyzing data, this section is following the order of the research objectives and their related statistical methods, as presented in [Figure 7](#).



*Figure 7. The Statistical Methods Utilized in the Quantitative Data analysis*  
*Source: researcher*

#### 4.2.1. Data Collection and Preparation for Analysis

The survey study was conducted in Algeria from June 25 to July 24. Both the paper- and- pen and the online options were utilized to distribute the questionnaire amongst seafarers. In this quantitative survey, 549 completed questionnaires were collected. Excluding questionnaires with unanswered items, the questionnaires of 418 were initially considered valid for the analysis. However, the initial descriptive analysis using the online data collection software showed some issues. For example, some participants responded randomly to all the questions using only one or two options (e.g., “Neutral/Agree”). Therefore, a filter using a time spent to answer the survey questionnaire was applied to ensure that the respondents had read the questions (i.e., time less than 5 minutes was considered insufficient to read and answer all the survey questions). After isolating the invalid questionnaires, the questionnaires of the remaining 373 respondents were assumed to be valid and utilized for the analysis, representing 67.9% of the total collected questionnaires.

The collected data was prepared for statistical analysis by coding them into SPSS 26.0 file. Responses to items containing negatively worded statements were reversed and re-coded; thus, higher recorded scores reflect a positive safety culture. As mentioned above, the questionnaires were collected from seafarers in Algeria, whatever their companies were; then, a new independent variable was computed using respondents’ background information, separating the respondents into four samples,

including the research targeted two samples, as described in [section 3.4.2](#). Finally, different descriptive analyses were performed using the SPSS to ensure that all the data were entered correctly and extracted respondents' demographic characteristics.

#### 4.2.2. Respondents Demographic Data

The 373 respondents were distributed on four samples, as discussed in the methodology chapter (see [section 3.4.2](#) ). First, the ocean-going ships' sample (A) included 82 respondents, representing 22%. Second, the ocean-going ships' sample (B1) included 117 respondents, representing 31.4%. Third, the domestic ships' sample (B2) included 89 respondents (23.9%). Finally, the domestic ships' sample (C) included 85 respondents, representing 22.8%. The details of the samples' respondents are given in [Table 3](#).

*Table 3. General Characteristics of Participants*

Division/ Type of ships		Ocean-Going (A)		Ocean-Going (B1)		Domestic (B2)		Domestic (C)		Total	
		No	Percent	No	Percent	No	Percent	No	Percent	No	Percent
The number of respondents		82	22%	117	31.4%	89	23.9%	85	22.8%	373	100%
Gender	Male	77	93.9%	108	92.3%	75	84.3%	85	100%	345	92.5%
	Female	5	6.1%	9	7.7%	14	15.7%	0	0.0%	28	7.5%
Age	Under 25 years	10	12.2%	3	2.6%	10	11.2%	8	9.4%	31	8.3%
	25-35 years	38	46.3%	66	56.4%	47	52.8%	38	44.7%	189	50.7%
	36-45 years	23	28.0%	24	20.5%	20	22.5%	11	12.9%	78	20.9%
	46-55 years	7	8.5%	15	12.8%	9	10.1%	18	21.2%	49	13.1%
	Above 55 years	4	4.9%	9	7.7%	3	3.4%	10	11.8%	26	7.0%
Rank	Officers	52	63.4%	107	91.4%	59	66.3%	75	88.2%	293	78.5%
	Ranking	30	36.6%	10	8.6%	30	33.7%	10	11.8%	80	21.5%
Years of service	Less than five years	27	32.9%	36	30.8%	37	41.6%	32	37.6%	132	35.4%
	5-10 years	27	32.9%	38	32.5%	22	24.7%	22	25.9%	109	29.2%
	11-15 years	13	15.9%	16	13.7%	10	11.2%	11	12.9%	50	13.4%
	16-20 years	7	8.5%	14	12.0%	7	7.9%	7	8.2%	35	9.4%
	More than 20 years	8	9.8%	13	11.1%	13	14.6%	13	15.3%	47	12.6%
Employment contract	Permanent	54	65.9%	74	63.2%	54	60.7%	51	60.0%	233	62.5%
	Temporary	28	34.1%	43	36.8%	35	39.3%	34	40.0%	140	37.5%

The personal profiles of respondents showed essential and relevant characteristics. The female gender represented 7.5% of the survey's respondents. However, in the research targeted samples (i.e., B1 and B2), females represented 9% in sample B1 and 14% in sample B2. Officers from both deck and machine departments represented 78.8% of the survey's respondents. Furthermore, 59% were under 35 years regarding the respondents' age, while only 7% were above 55 years. The distribution also shows that 65.6% of respondents had more than five years of seafaring experience. In particular, from this experienced seafarer's category, 35.4% of them had more than ten years, reflecting abundant experience in every single sample of the participants. Last and not least, in all the samples, around 60 to 65% of respondents had permanent contact with their employers.

In summary, the survey participation resulted in a balanced distribution in the number of participants between the samples. Furthermore, the participants' profile shows meaningful characteristics such as age group of 25-35 years, the rank of officers, and the experience of more than 5 years. Therefore, in addition to the representative character of the study samples, the survey respondents appear to be the current and the future leaders of shipping in Algeria. This fact is likely to add more relevance and importance to the conducted study.

#### 4.2.3. Validity and Reliability

##### 4.2.3.1. Exploratory Factor Analysis

A survey questionnaire intends to obtain relevant information from the respondents most reliably and validly (Taherdoost, 2016). Thus, the validity and reliability of the measurement tool are considered essential for any study when designing questionnaires and performing statistical analyses. Accordingly, validity analysis is necessary for the research to confirm the accuracy of the survey measurement tool in measuring what is supposed to be measured, and therefore covering the actual investigation area. Reliability analysis, on the other hand,

demonstrates the consistency of the survey tool. It indicates the extent to which the questions asked in a survey extract the same information each time they are asked different respondents (Taherdoost, 2016; Field, 2005). Therefore, a reliability analysis is the first step in the process of validating a measurement tool. If the measurement tool is not reliable, indeed, it cannot be valid.

Therefore, an exploratory factor analysis (EFA)<sup>1</sup>, using SPSS 26, was first performed in this data analysis. In this study, the survey questionnaire comprised various questions (i.e., items) connected to several aspects that were identified to be linked to the topic of interest and achieve the research aim and objectives. Then, exploratory factor analysis was performed to explore and define the underlying factors and structure the dataset. However, before conducting such an analysis, first, the Bartlett test of sphericity<sup>2</sup> and Kaiser-Mayer Olkin (KMO) test<sup>3</sup> were performed to examine the data suitability to conduct an exploratory factor analysis (Song, 2015). The obtained values for both tests were satisfactory (i.e., more than 0.8 for KMO's test and less than 0.01 for the Bartlett test of sphericity), as shown in [Table 4](#).

*Table 4. KMO and Bartlett Tests Result for Sampling Adequacy*

Kaiser-Meyer-Olkin measure of sampling adequacy		0.865
Bartlett test of sphericity	Approx. Chi-square	4205.991
	Df	703
	p	<0.001

Using SPSS's component extraction and Varimax rotation, and considering the following criteria: (1) Pairwise deletion; (2) Eigenvalue more than 1.0; and (3) at least three items in the factor with minimum loading of 0.5 (Field, 2005). The exploratory factor analysis resulted in the extraction of 8 factors, cumulating 65.692 of the total

<sup>1</sup> Exploratory Factor Analysis (EFA) is a technique to identify the cluster of variables. It helps to understand the dataset's structure, construct the questionnaire to measure an underlying variable, and reduce the dataset to a more manageable size (Field, 2005).

<sup>2</sup> Bartlett test of Sphericity compares a correlation matrix to check if there is redundancy between variables that can be categorized with a few numbers of factors.

<sup>3</sup> A Kaiser-Meyer-Olkin (KMO) test is used to determine the adequacy of the data sample for performing Factor Analysis.

variances. The items based on their relationships and intercorrelations were categorized together (i.e., factors) and named as shown in [Table 5](#). In fact, the eight extracted factors, representing different aspect related to the safety culture onboard ships, were named as follows: (*Factor name in italic*):

**Factor 1:** *Top Management<sup>4</sup> Commitment*, reflecting the crew perception of the commitment of the shore-side of the organization towards prioritizing and proactively improving the onboard safety

**Factor 2:** *Safety Management System*, reflecting the crew perception of the management safety practices and resources (i.e., other than human resources) devoted to improving shipboard's safety, such as the adequate documentation, new members' safety familiarization, sharing safety information, and the supporting rules and procedures.

**Factor 3:** *Safety- related Human Resource*, reflects the perceived adequate safety manning, regarding crew size and its training to handle safety on board.

**Factor 4:** *Local Management<sup>5</sup> Involvement*, reflects the crew perception of the involvement of the Master and their immediate superiors in prioritizing safety and applying the safety rules, including punishment for violating rules, contributing to the reporting system, and organizing the workload to not impede safety procedures.

**Factor 5:** *Crew Psychological Safety*, reflects the crew cohesion, its communication openness, the team shared trust, and the resulted team climate that motivates individuals to ask for help, report their mistakes without fear of blame, and voluntary participation in safety improvement.

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<sup>4</sup> Top management in this research refers to the shore-side of the shipping company responsible for ships' management including safety management.

<sup>5</sup> Local management refers in the research to the machine and deck senior and junior officers on board ships.



**Factor 6:** *Crew<sup>6</sup> Safety Behavior*, reflects the crew reported safety attitudes and practices, including their compliance with the safety rules and their voluntary participation in activities that improve safety on board.

**Factor 7:** *Crew Job Satisfaction*, reflects the seafarer's perception about their satisfaction regarding belonging to the company, seafaring job, salary and career promotion, and the working conditions on board.

**Factor 8:** *External Supervision Pressure*, reflects the seafarers' recognition of stress and pressure introduced by the external supervisions carried out on board ships, including port and flag State controls and other safety inspections and audits.

Factor 1, 2, and 3 were considered as organizational factors. While factors 4, 5, 6, and 7 were considered shipboard safety culture factors, factor 8 represented an external factor.

#### 4.2.3.2. Reliability and Validity Test

The Cronbach alpha value was used to estimate the internal consistency between the combined items in the same factor for the scale's reliability. As a rule of thumb, the following criteria were applied: (1) a minimum of the alpha value of 0.7; (2) item-total correlation more than 0.4; and (3) inter-item correlation more than 0.30 and less than 0.80 (Field, 2005; Tabachnick & Fidell, 2000). In total, between the factor analysis and the reliability test steps, nine items were considered less reliable. Therefore, they were removed (i.e., seven items were removed in the exploratory factor analysis step and two items due to their failure in the reliability test). The final test confirmed that all factors and their items satisfied the reliability conditions. Therefore, the obtained Cronbach alpha value of the overall 37 items' questionnaire was 0.921, and those for the listed factors were more than 0.7 each. Also, the rule for minimum loading of items was respected, as shown in [Table 5](#).

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<sup>6</sup> In this research, the terms "crew" and "seafarers" were utilized interchangeably.

*Table 5: Results of The Exploratory Factor Analysis and Reliability Test*

Factor name	Alpha	Eigen value	Item	Factor loading	Item-total correlation
Top Management Commitment (TMC)	0.764	2.042	Q1	0.845	0.627
			Q3	0.821	0.590
			Q5	0.808	0.574
Safety Management System (SMS)	0.782	2.687	Q25	0.610	0.566
			Q26	0.576	0.523
			Q9	0.616	0.549
			Q17	0.585	0.529
			Q27	0.728	0.627
Safety Human Resources (SHR)	0.749	2.025	Q18	0.882	0.656
			Q19	0.896	0.686
			Q20	0.666	0.412
Local Management Involvement (LMI)	0.770	2.025	Q4	0.579	0.409
			Q6	0.612	0.449
			Q7	0.739	0.594
			Q11	0.721	0.551
			Q23	0.630	0.456
Crew Phycological Safety (CPS)	0.747	2.692	Q10	0.779	0.629
			Q29	0.631	0.431
			Q30	0.764	0.581
			Q31	0.728	0.546
			Q32	0.675	0.512
			Q33	0.627	0.459
Crew Safety Behaviors (SCB)	0.711	2.478	Q39	0.577	0.406
			Q13	0.720	0.530
			Q14	0.741	0.542
			Q15	0.637	0.442
			Q8	0.513	0.330
			Q16	0.660	0.457
Crew Job Satisfaction (CJS)	0.701	2.104	Q12	0.553	0.368
			Q34	0.525	0.310
			Q35	0.745	0.494
			Q36	0.493	0.306
			Q37	0.654	0.400
External Supervision Pressure (ESP)	0.806	1.909	Q38	0.776	0.552
			Q43	0.859	0.612
			Q44	0.811	0.529
			Q45	0.716	0.436

#### 4.2.4. Normality Test

The statistical analyses might require the utilization of various tests. The choice of an adequate test depends on the nature of the distribution of data. Thus, the literature

provides several methods and tests to check the normal distribution of data, such as graphical assessment of normality, Kolmogorov-Smirnov test, Shapiro-Wilk test, Lilliefors corrected K-S test, D'Agostino skewness test, and Jarque-Bera test (Ghasemi & Zahediasl, 2012). Among these tests, the Kolmogorov Smirnov test appears to be very popular, and the rule of thumb is a p-value greater than 0.05 (Ghasemi & Zahediasl, 2012; Thode, 2002). Therefore, in this research, in addition to visual observations, the Kolmogorov Smirnov test for independent samples, using SPSS, was performed to test the null hypothesis that the data follows from a normal distribution. The SPSS's computed results indicated that there were no significant violations of normality. Therefore, parametric, rather than non-parametric tests, were used in the following data analysis.

#### 4.3. Analysis of the Survey Data

The researcher analyzed the survey questionnaire data in such a way the findings can address the research objectives, as described in [Figure 7](#).

The first research objective was to identify the key safety culture elements that influence safety culture on board ocean-going and domestic ships. The exploratory factor analysis resulted in extracting eight safety culture factors. Then, as a second step, a correlation analysis was performed to examine the degree of correlation (i.e., impact) of the safety culture factors, and therefore, identifying the most influential factors on safety culture.

##### 4.3.1. Correlation Analysis of Safety Culture Factors

Bivariate correlation analysis was conducted using the SPSS tool to examine the associations amongst the eight safety culture factors. All the data collected from the 373 seafarers, including samples A, B1, B2, and C, was used in this analysis.

In interpreting the analysis results, the closer the value of Pearson Correlation Coefficient to  $\pm 1$ , the higher the correlation, and the closer the value to 0, the lower the factors' correlation (Field, 2005). [Table 6](#) presents the correlation analysis result

*Table 6. Results of the Correlation Analysis of Safety Culture Factors.*

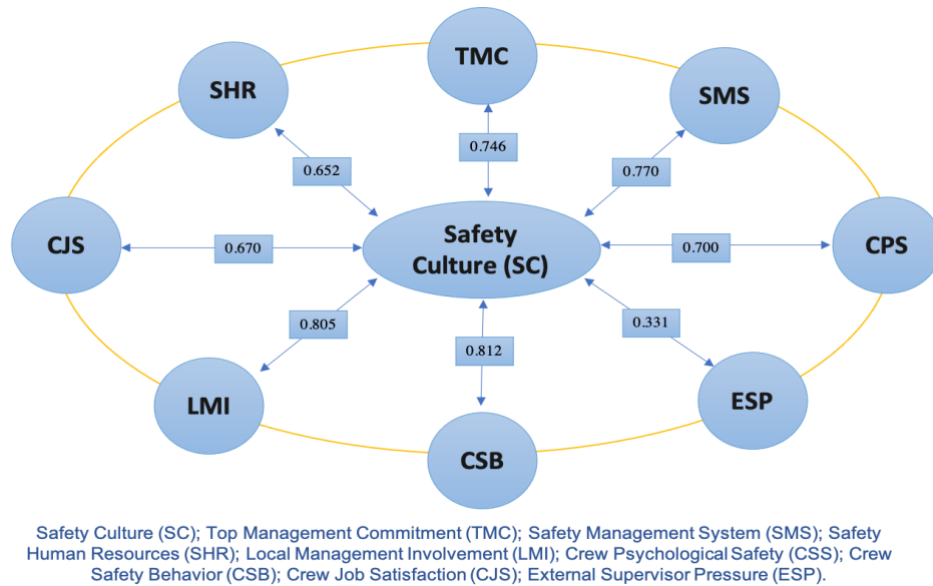
		SC	TMC	SMS	SHR	LMI	CPS	CSB	CJS	ESP
SC	Pearson Correlation	1								
	Sig.(2-tailed)									
TMC	Pearson Correlation	.746	1							
	Sig.(2-tailed)	.000								
SMS	Pearson Correlation	.770	.566**	1						
	Sig.(2-tailed)	.000	.000							
SHR	Pearson Correlation	.652	.340**	.380**	1					
	Sig.(2-tailed)	.000	.000	.000						
LMI	Pearson Correlation	.805	.476**	.578**	.447**	1				
	Sig.(2-tailed)	.000	.000	.000	.000					
CPS	Pearson Correlation	.700	.393**	.496**	.367**	.619**	1			
	Sig.(2-tailed)	.000	.000	.000	.000	.000				
CSB	Pearson Correlation	.812	.586**	.655**	.410**	.731**	.559**	1		
	Sig.(2-tailed)	.000	.000	.000	.000	.000	.000			
CJS	Pearson Correlation	.670	.482**	.475**	.276**	.451**	.476**	.534**	1	
	Sig.(2-tailed)	.000	.000	.000	.000	.000	.000	.000		
ESP	Pearson Correlation	.331	.138	.086	.144	.108	.083	.070	.115	1
	Sig.(2-tailed)	.000	.023	.160	.018	.076	.171	.250	.058	

\*\* Correlation significant at the 0.05 level (2-tailed).

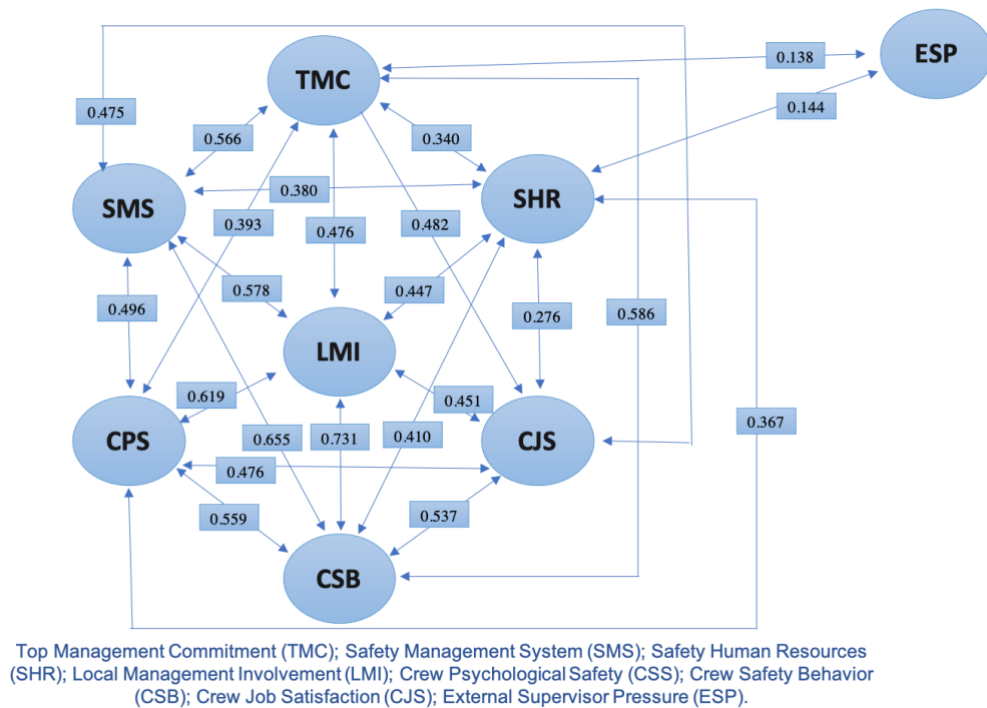
Overall Safety Culture (OSC); Top Management Commitment (TMC); Safety Management System (SMS); Safety Human Resources (SHR); Local Management Involvement (LMI); Crew Psychological Safety (CSS); Crew Safety Behavior (CSB); Crew Job Satisfaction (CJS); External Supervisor Pressure (ESP).

The correlation analysis between the overall safety culture (SC) and its factors showed that the lowest correlation was with external supervision pressure (ESP). However, the highest correlations were with crew safety behavior and local management involvement at .812 and .805, respectively. The other six factors ranged between .652 and .770, reflecting high correlation with the overall safety culture too. Additionally, by comparing the correlation of the eight safety culture factors *inter se*, the analysis results showed no significant correlation between the external supervision pressure (ESP) and all the remaining seven factors. However, the reported crew safety behavior was highly correlated with the perceived local management involvement (LMI) and safety management system (SMS) effectiveness, recording .731 and .655, respectively. Local management involvement (LMI) also had a high correlation with

the perceived crew psychological safety (CPS). **Figure 8** and **Figure 9** recapitulate the correlation analysis results.



**Figure 8.** Correlation between Safety Culture and its Factor



**Figure 9.** Correlation between the Safety Culture Factors.

To conclude, the correlation analysis provided the research an overview regarding the degree to which the factors affect the overall safety culture score. In particular, the analysis showed marginal influence of the external safety supervisions on safety culture. In contrast, the remaining seven safety culture factors were highly correlated with the overall safety culture, leading the researcher to consider the aforementioned seven factors as key elements that influence safety culture of both ocean-going and domestic ships.

The second research objective aimed to investigate the influence of differing the organizational culture related to safety, in the same shipping company, on safety culture. To achieve this objective, the study conducted a comparative analysis of safety culture factors between ocean-going and domestic ships, followed by a hypothesis testing.

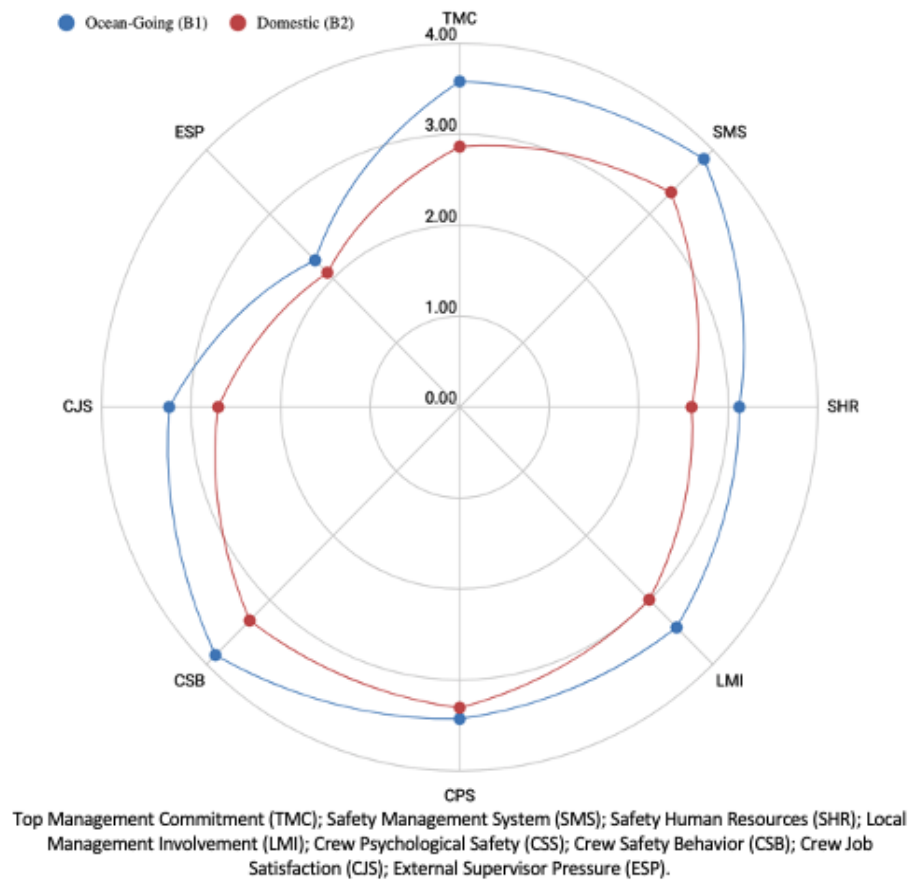
#### 4.3.2. Comparative Analysis of Safety Culture Factors.

The study first compared the eight safety culture factors between the two samples of respondents belonging to the same company, as described in [section 3.4.2](#), namely: (1) Ocean-Going ships (Sample B1); (2) Domestic ships (Sample B2).

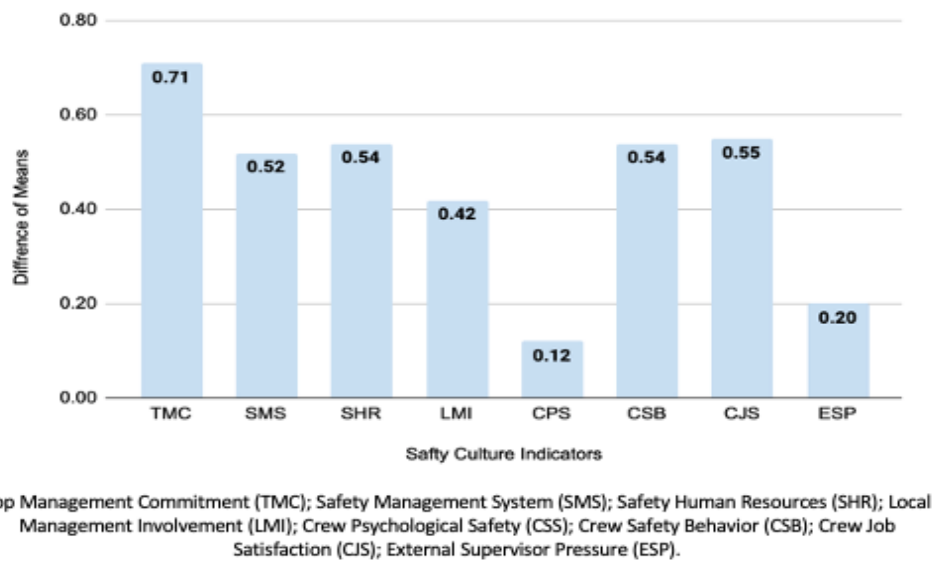
The results of the comparative analysis are summarized in [Table 7](#), [Figure 10](#), and [Figure 11](#).

**Table 7.** *Comparison of Safety Culture Factors' Scores between Ocean-Going and Domestic Ships of the Same Company with Interchanging Crews.*

Division	Mean		Standard Deviation	
	Ocean-Going (B1)	Domestic (B2)	Ocean-Going (B1)	Domestic (B2)
Top Management Commitment (TMC)	3.58	2.87	0.94	1.02
Safety Management System (SMS)	3.85	3.33	0.87	0.88
Safety Human Resources (SHR)	3.13	2.59	1.24	1.10
Local Management Involvement (LMI)	3.42	3.00	1.01	0.87
Crew Psychological Safety (CPS)	3.43	3.31	0.76	0.74
Crew Safety Behavior (CSB)	3.85	3.31	0.80	0.58
Crew Job Satisfaction (CJS)	3.24	2.69	0.82	0.66
External Supervision Pressure (ESP)	2.29	2.09	0.95	0.84



*Figure 10. Comparison of Means' Value of Safety Culture Factors between Ocean-Going and Domestic Ships of the Same Company with Interchanging Crews.*



*Figure 11. Differences of Means of Safety Culture Factors between Ocean-Going and Domestic ships of the Same Company with Interchanging Crews.*

According to [Table 7](#) and the radar plot graph in [Figure 10](#), it can be seen that there are noticeable differences of the mean value in each safety culture factor between ocean-going and domestic ships of the same company with interchanging crews. The mean values of organizational commitment toward safety were 3.58 and 2.87 for ocean-going and domestic ships, respectively. The mean values of the safety management system were 3.85 and 3.33 for ocean-going and domestic ships, respectively. The crew safety behavior followed the same trend, recording 2.85 and 3.31 for ocean-going and domestic ships, respectively.

However, according to [Figure 11](#), the mean differences of the eight safety culture factors between ocean-going and domestic ships are not stable. The top management commitment had the highest mean difference of 0.71. In contrast, the safety management system, human resource for safety, crew safety behavior, and crew job satisfaction recorded almost the same mean difference, between 0.52 and 0.55. The crew psychological safety and the external supervision pressure had the lowest differences, recording 0.12 and 0.20, respectively.

Although the results showed apparent, but unbalanced, differences in the safety culture factors scores between ocean-going and domestic ships, statistically, it cannot be said that there are significant differences. Further statistical analysis is needed to verify the hypothesis H1, and therefore to address the research objective.

#### 4.3.3. Hypothesis Testing- Hypothesis H1

This section intended to verify hypothesis H1, developed in the qualitative data analysis (see [section 4.1.3](#)). To achieve this goal, eight sub-hypotheses were established (see [Table 9](#)). Accordingly, an independent t-test was performed to determine whether there is statistical evidence that mean value of each factor of the associated samples are significantly different. A “**p-value**” less than 0.05 and an absolute value of t-test more than one were considered conditions to support hypotheses. However, statistically, the calculation methods of the independent sample t-test rely on the degree of homogeneity of variance between the two compared samples (Rasch et al., 2011). Therefore, SPSS, when running an independent sample



t-test, systematically runs a test called Levene's Test for the homogeneity of variance. In this analysis, the assumption of “equal variance assumed” was violated for all the safety culture factors (i.e., the related p-value of Levene’s test is more than 0.05). Thus, the comparative analysis considered the t and p values that correspond to the case of “equal variance not assumed”. Table 8 displays the results of the t-Test.

*Table 8. Result of the t-test for Comparing Safety Culture Factors Between B1(Ocean-Going ships) and B2(Domestic ships).*

Division	Mean		Standard Deviation		t	p
	Ocean-Going (B1)	Domestic (B2)	Ocean - Going (B1)	Domestic (B2)		
Top Management Commitment (TMC)	3.58	2.87	0.94	1.02	5.143	<0.001
Safety Management system (SSS)	3.85	3.33	0.87	0.88	3.907	<0.001
Safety Human Resources (SHR)	3.13	2.59	1.24	1.10	2.983	0.003
Local Management Involvement (LMI)	3.42	3.00	1.01	0.87	3.212	0.002
Crew Psychological Safety (CPS)	3.43	3.31	0.76	0.74	0.985	0.326
Crew Safety Behavior (CSB)	3.85	3.31	0.80	0.58	5.141	<0.001
Crew Job Satisfaction (CJS)	3.24	2.69	0.82	0.66	4.830	<0.001
External Supervision Pressure (ESP)	2.29	2.09	0.95	0.84	1.487	0.139

According to the results analysis, it can be concluded that H1.1, H1.2, H1.3, H1.4, H1.6, and H1.7 were supported, whereas H1.5 and H1.8 were rejected, as summarized in Table 9. The results showed no significant differences (i.e., p-value>0.05) in the perceived pressure caused by external supervision (H1.8) and in the perceived crew psychological safety (H1.5) between ocean-going and domestic ships’ crews. On the other hand, there were significant differences (t> one and p-value<0.05) between ocean-going and domestic ships in the perceived top management commitment (H1.1); the safety management system effectiveness (H1.2); safety related human sources (H1.3); the local management involvement (H1.4); the reported crew safety behavior (H1.6); and in the perceived crew job satisfaction (H1.7).

*Table 9. Results of the Research Hypothesis (H1) Testing.*

No.	Hypothesis Description	t-Test results
H1.1	In the same company, the perceived top management commitment toward improving ocean-going ships' safety significantly differs from domestic ships.	Supported
H1.2	In the same company, the perceived effectiveness of the safety management system of ocean-going ships significantly differs from that of domestic ships.	Supported
H1.3	In the same company, the perceived adequacy and qualification of human resources devoted to the ocean-going ships significantly differ from domestic ships.	Supported
H1.4	In the same company, the perceived involvement of local management of ocean-going ships in safety significantly differs from that of domestic ships.	Supported
H1.5	In the same company, the perceived phycological safety of ocean-going crew differs from that of domestic ships.	Rejected
H1.6	The reported safety behavior of ocean-going ships' crew differs from that of domestic ships' crew.	Supported
H1.7	In the same company, the perceived job satisfaction of ocean-going crew significantly differs from that of domestic ships' crew.	Supported
H1.8	In the same company, the perceived pressure caused by external supervisions of ocean-going crew significantly differs from that of domestic ships' crew.	Rejected

It can be concluded that the research support to a large extent (75%) the main hypothesis (H1) that: *“the organizational culture affects safety culture and results in safety subcultures in the same organization, even with the same employees with the same qualifications”*.

Finally, the third research objective aimed to investigate the way the organizational factors affect safety culture on board ships. Previously, correlation analysis confirmed a likelihood of identifying significant effects of some factors on others. However, correlation analysis lacks the ability to predict the direction of effects

between factors, as well as to explain how combination of a number of factors would affect a third factor. This limitation can be overcome by regression analysis. As stated by Archdeacon (1994, p.238), “regression coefficients naturally yield more information than correlations about the relationship between variables”.

#### 4.3.4. Regression Analysis of Safety Culture Factors

Regression is the most widely used statistical analysis, which provides a complete coverage of the statistical methods of statistical analyses that enable discovering the relationship between variables (Freund et al., 2006; Draper & Smith, 1998). In this study, regression analysis was used to discover the relationship between the safety culture factors, and therefore to address the third research objective. The correlation analysis showed a weak correlation of external supervision pressure (ESP) to the other factors. Thus, in the regression analysis, the study considered seven dependent factors by excluding this factor (i.e., ESP), but this latter was considered with the independent factors in each regression. In total, seven separated regression analyses were performed; each regression took one safety culture factor as dependent variable and regressed it on the others. The results of the organizational factors and the shipboard safety climate factors are presented in [Table 10](#) and [Table 11](#), respectively.

*Table 10. Results of the Linear Regression of Safety Culture Factors- Part 1  
(Organizational factors)*

Dependent variable	Independent Variables	B	t	p-value	R <sup>2</sup>
Safety related Human Resources (SHR)	Crew Safety Behavior (CSB)	.074	.806	.421	.243
	Crew Job Satisfaction (CJS)	-.008	-.116	.908	
	Crew Psychological Safety (CPS)	.105	1.454	.147	
	Local management Involvement (LMI)	.224*	2.573	.011	
	Safety Management System (SMS)	.103	1.333	.184	
	Top Management Commitment (TMC)	.070	.978	.329	
	External supervision Pressure (ESP)	.088	1.616	.107	
Top Management Commitment (TMC)	Crew Safety Behavior (CSB)	.211*	2.717	.007	.445
	Crew Job Satisfaction (CJS)	.180*	3.222	.001	
	Crew Psychological Safety (CPS)	-.050	-.811	.418	
	Local management Involvement (LMI)	.116	1.548	.23	
	Safety Management System (SMS)	.286*	4.458	<.001	
	Safety related Human Resource (SHR)	.052	.978	.329	
	External supervision Pressure (ESP)	.062	1.329	.185	
Safety Management System (SMS)	Crew Safety Behavior (CSB)	.327*	4.640	<.001	.522
	Crew Job Satisfaction (CJS)	.076	1.417	.158	
	Crew Psychological Safety (CPS)	.101	1.766	.079	
	Local management Involvement (LMI)	.091	1.298	.195	
	Safety related Human Resource (SHR)	.065	1.333	.184	
	Top Management Commitment (TMC)	.246*	4.458	<.001	
	External supervision Pressure (ESP)	-.008	-.175	.861	

\*Significant value at the level of  $p < .05$ .

According to the linear regression analysis of the organizational safety culture factors, there were significant evidence ( $p\text{-value} < .05$ ) that:

- The crew members perception of their local management involvement in safety affects their perception regarding the adequacy of the safety related human resources.
- The crew members' safety behavior, job satisfaction, and perception regarding the effectiveness of safety management system affect their perception regarding the top management commitment toward safety.
- The crew members' safety behavior and perception regarding the top management commitment toward safety affect their perception regarding the effectiveness of safety management system.

*Table 11. Results of the Linear Regression of Safety Culture Factors- Part 2  
(Shipboard' safety climate factors)*

Dependent variable	Independent Variables	B	t	p-value	R <sup>2</sup>
Crew Safety Behavior (CSB)	Crew Job Satisfaction (CJS)	.137*	3.030	.003	.659
	Crew Psychological Safety (CPS)	.052	1.079	.282	
	Local management Involvement (LMI)	.432*	8.183	<.001	
	Safety Management System (SMS)	.232*	4.673	<.001	
	Safety related Human Resource (SHR)	.033	.706	.481	
	Top Management Commitment (TMC)	.129*	2.646	.007	
	External supervision Pressure (ESP)	-.039	-1.072	.285	
Crew Job Satisfaction (CJS)	Crew Safety Behavior (CSB)	.253*	3.078	<.001	.407
	Crew Psychological Safety (CPS)	.231*	3.599	.002	
	Local management Involvement (LMI)	-.047	-.590	.556	
	Safety Management System (SMS)	.100	1.417	.158	
	Safety related Human Resource (SHR)	-.006	-.117	.908	
	Top Management Commitment (TMC)	.207*	3.222	.001	
	External supervision Pressure (ESP)	.047	.948	.344	
Crew Psychological Safety (CPS)	Crew Safety Behavior (CSB)	.084	1.072	.258	.450
	Crew Job Satisfaction (CJS)	.203*	3.599	<.001	
	Local management Involvement (LMI)	.389*	5.455	<.001	
	Safety Management System (SMS)	.116	1.766	.079	
	Safety related Human Resource (SHR)	.076	1.454	.147	
	Top Management Commitment (TMC)	-.050	-.811	.418	
	External supervision Pressure (ESP)	-.002	-.040	.968	
Local management Involvement (LMI)	Crew Safety Behavior (CSB)	.471*	8.195	<.001	.630
	Crew Job Satisfaction (CJS)	-.028	-.590	.556	
	Crew Psychological Safety (CPS)	.261*	5.455	<.001	
	Safety Management System (SMS)	.070	1.273	.195	
	Safety related Human Resource (SHR)	.109*	2.573	.011	
	Top Management Commitment (TMC)	.078	1.548	.123	
	External supervision Pressure (ESP)	.024	.628	.531	

\*Significant value at the level of  $p < .05$ .

According to the linear regression analysis of the shipboard's safety climate factors, there were significant evidence ( $p\text{-value} < .05$ ) that:

- The crew members' job satisfaction and perceptions regarding local management involvement, effectiveness of safety management system and top management commitment affect their safety behavior.
- The crew members' safety behavior, and their perceptions regarding psychological safety on board and the top management commitment influence their job satisfaction.

- The crew members' job satisfaction and the perceived local management involvement affect the crew perception regarding psychological safety on board.
- The crew members' safety behavior, and their perceived shipboard psychological safety and adequacy of human resources influence their perception of the local management involvement in safety.

To conclude, the linear regression analysis yielded abundant information regarding the relationship between the safety culture factors. However, here, the predicted effects are linear and cannot explain, for instance, the interaction between two factors that affect the third factor, which exists in practice. Therefore, to properly address this research objective, there was a need for a further regression analysis, called “moderated regression analysis”, aiming to collect more information regarding the relationship between the safety culture factors.

#### 4.3.5. Moderated Regression Analysis of Safety Culture Factors

##### 4.3.5.1. Moderated Regression Analysis Method

In statistics, moderated regression analysis is frequently used to test whether a third variable affects the relationship between the dependent and independent variables (Tharenou et al., 2007). This third variable is called a moderator, which affects the direction and the strength of the relation between the dependent and independent variables (Tabachnick and Fidell, 2000). Thus, in the moderator model, three paths may lead to the dependent variable (Baron and Kenny, 1986):

- The way the independent variable ( $x$ ) impacts the dependent variable ( $y$ );
- The way the moderator variable ( $m$ ) affects the dependent variable ( $y$ ); and
- The interaction of the moderator variable and the independent variable ( $m.x$ ) that impacts the dependent variable ( $y$ ).

In addition, to avoid multicollinearity, Baron and Kenny (1986) suggested that the moderator and the independent variables need to be centered. Also, they postulated, in

the regression model, that the variable ( $y$ ) is a linear function of the variable ( $x$ ), and the interaction ( $x.m$ ), as shown in (1):

$$y = \beta_0 + \beta_1.x + \beta_2.m + \beta_3.x.m + \varepsilon \quad (1)$$

The intercept  $\beta_0$  and the slopes  $\beta_1$ ,  $\beta_2$ , and  $\beta_3$  are unknown coefficients and  $\varepsilon$  is a random error constant.

To facilitate the interpretation of the results, Cohen et al. (2003) suggest plotting the regression of  $y$  on  $x$  on three values of  $m$  (i.e., the mean of  $m$ , the low value, and the high value of  $m$ ); in fact, the low and high values of  $m$  can be one standard deviation below the mean (i.e., low value) and one above the mean (i.e., high value). As a result, three plotted lines for the regression of  $y$  on  $x$  at three values of  $m$  can be compared with each other.

#### 4.3.5.2. Moderated Regression Analysis Results

This analysis intended to investigate how the organizational factors can moderate the impact of the shipboard's safety climate factors (CJS, CPS, and LMI) on the crew safety behavior (CSB). Specifically, moderated regression analysis was used to test whether the top management commitment (TMC), safety-related human resources (SHR), and safety management system (SMS), as moderators ( $m$ ), influence the impact of crew job satisfaction (CJS), local management involvement (LMI), and crew psychological safety (CPS), as independent variables ( $x$ ) on the crew safety behavior (CSB) as dependent variable ( $y$ ).

Subsequently, nine models were examined using the SPSS tool as follows:

**Model 1** regressed CSB on CJS and TMC, and the product of TMC and CJS.

**Model 2** regressed CSB on CPS and TMC and the product of TMC and CPS.

**Model 3** regressed CSB on LMI and TMC and the product of TMC and LMI.

**Model 4** regressed CSB on CJS and SHR and the product of SHR and CJS.

**Model 5** regressed CSB on CPS and SHR and the product of SHR and CPS.

**Model 6** regressed CSB on LMI and SHR, and the product of SHR and LI



**Model 7** regressed CSB on CJS and SMS and the product of SMS and CJS.

**Model 8** regressed CSB on CPS and SMS and the product of SMS and CPS.

**Model 9** regressed CSB on LMI and SMS and the product of SMS and LMI.

First, as discussed before, to avoid multicollinearity, the moderators (TMC, SHR, and SMS) and the independent variables (CJS, LMI, and CPS) were centered by extracting the related mean for each variable. [Table 12](#) and [Table 13](#) show the results of the regression analyses.

***Table 12:** Impacts of Crew Job Satisfaction (CJS), Crew Psychological Safety (CPS) and Local Management Involvement (LMI) on Crew Safety Behavior (CSB) Moderated by the Top Management Commitment (TMC).*

Variable	Model 1		
	Coef.	t	p-value
CJS	.330	6.179	<.001
TMC	.442	7.947	<.001
CJS*TMC	-.007	-.152	.808
F	64.999		
p-value	<.001		
R <sup>2</sup>	.442		
Product contribution to R <sup>2</sup>	.007		

Variable	Model 2		
	Coef.	t	p-value
CPS	.388	7.776	<.001
TMC	.429	8.776	<.001
CPS*TMC	-.011	-.243	.808
F	78.126		
p-value	<.001		
R <sup>2</sup>	.467		
Product contribution to R <sup>2</sup>	.011		

Variable	Model 3		
	B	t	p-value
LMI	.575	13.496	<.001
TMC	.298	6.975	<.001
LMI*TMC	-.104*	-2.838	0.005
F	152.713		
p-value	<.001		
R <sup>2</sup>	.607		
Product contribution to R <sup>2</sup>	.074		

**Interpretation:** [Table 12](#) indicates that no significant evidence ( $p < .05$ ) exists that top management commitment (TMC) moderates or influences the impact of crew



job satisfaction (CJS), and crew psychological safety (CPS) on the crew safety behavior (CSB). However, there are significant evidence ( $p>0.05$ ) that the top management commitment (TMC) moderates by 10.4% the impact of the local management involvement (LMI) on the crew safety behavior (CSB).

*Table 13. Impact of Crew Job Satisfaction (CJS), Crew Psychological Safety (CPS) and Local Management Involvement (LMI) on Crew Safety Behavior (CSB) Moderated by the Safety Human Resources (SHR).*

Variable	Model 4		
	B	t	p-value
CJS	.437	8.597	<.001
SHR	.287	5.705	<.001
CJS*SHR	.123*	2.515	.013
F	53.275		
p-value	<.001		
Adjusted R <sup>2</sup>	.474		
Product contribution to R <sup>2</sup>	.014		

Variable	Model 5		
	Coef.	t	p-value
CPS	.459	8.96	<.001
SHR	.239	4.645	<.001
CPS*SHR	.169*	3.519	.0001
F	56.668		
p-value	<.001		
Adjusted R <sup>2</sup>	.489		
Product contribution to R <sup>2</sup>	.033		

Variable	Model 6		
	Coef.	t	p-value
LMI	.698	15.100	<.001
SHR	.098	2.146	.033
LMI*SHR	-.013	-.316	.752
F	111.141		
p-value	<.001		
Adjusted R <sup>2</sup>	.489		
Product contribution to R <sup>2</sup>	.002		

**Interpretation:** Table 13 shows that no significant evidence ( $p<.05$ ) exists that safety-related human resources (SHR) influences or moderates the impact of local management involvement (LMI) on the crew safety behavior (CSB). However, there is significant evidence ( $p>0.05$ ) that safety human resource increases the impact of

crew job satisfaction (CJS), and crew psychological safety (CPS) on the crew safety behavior (CSB) by 12.3% and 16.9%, respectively.

**Table 14.** *Impact of Crew Job Satisfaction (CJS), Crew Psychological Safety (CPS) and Local Management Involvement (LMI) on Crew Safety Behavior (CSB) Moderated by the Safety Management System (SMS).*

Variable	Model 1		
	Coef.	t	p-value
CJS	.330	6.179	<.001
TMC	.442	7.947	<.001
CJS*TMC	-.007	-.152	.808
F	64.999		
p-value	<.001		
R <sup>2</sup>	.442		
Product contribution to R <sup>2</sup>	.007		

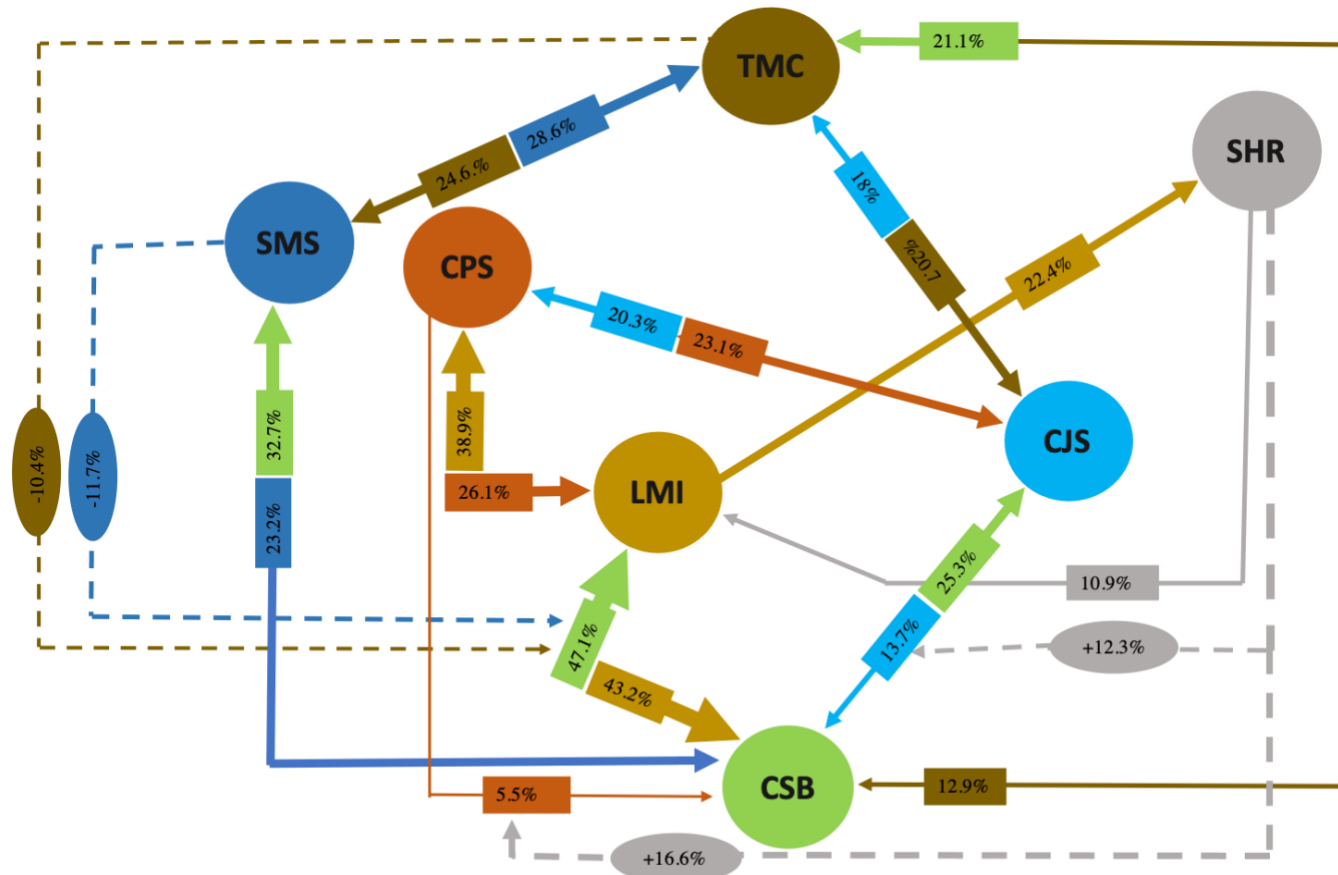
Variable	Model 2		
	Coef.	t	p-value
CPS	.388	7.776	<.001
TMC	.429	8.776	<.001
CPS*TMC	-.011	-.243	.808
F	78.126		
p-value	<.001		
R <sup>2</sup>	.467		
Product contribution to R <sup>2</sup>	.011		

Variable	Model 3		
	B	t	p-value
LMI	.575	13.496	<.001
TMC	.298	6.975	<.001
LMI*TMC	-.104*	-2.838	0.005
F	152.713		
p-value	<.001		
R <sup>2</sup>	.607		
Product contribution to R <sup>2</sup>	.074		

**Interpretation:** Table 14 shows that no significant evidence ( $p < .05$ ) exists that the safety management system (SMS) influences or moderates the impact of crew job satisfaction (CJS) and crew psychological safety (CPS) on the crew safety behavior (CSB). However, there is significant evidence ( $p > 0.05$ ) that the safety management system (SMS) moderates by 11.7% the impact of local management involvement (LMI) on the crew safety behavior (CSB).

To conclude, the regression analysis in two steps, linear and then moderated, provided deep understanding regarding the relationship between the safety culture factors. Specifically, it provided an explanation about how the organizational factors (TMC, SMS, and SHR) affect safety culture, especially crew member safety behavior that has direct influence on safety outcomes, as argued by many researchers, e.g., Yu et al. (2021); He et al. (2020); Aryee and Hsiung (2016). [Figure 12](#) recapitulates the findings of the regression analyses.



Top Management Commitment (TMC); Safety Management System (SMS); Safety Human Resources (SHR); Local Management Involvement (LMI); Crew Psychological Safety (CPS); Crew Safety Behavior (CSB); Crew Job Satisfaction (CJS)

*Figure 12. Safety Culture Model, Including Moderation Effects of Organizational Factors (Source: researcher)*

#### 4.4. Summary of the Main Findings

This study investigated the existence of different safety subcultures in the same shipping company as a result of differing the organizational culture between the company's divisions. A case study of shipping companies operating both ocean-going and domestic ships with the interchanging crews was examined to achieve this aim. The results of the study are as follows.

##### 1. Results of the Exploratory Survey:

The exploratory survey consisted of six interviews with Masters, Chief Engineers, an ISM Code inspector, and a Classification Society inspector. They were conducted to investigate the differences regarding safety culture between the two shipping company's activities (i.e., International and domestic shipping). The results summarized the differences in four main categories related to safety culture: (1) top management, (2) shipboard safety climate, (3) job satisfaction, and (4) pressure and stress on board ships. Based on the details of these themes (i.e., fifteen themes), a measurement tool of safety culture was developed. It covered different topics suggested to have a link to safety culture. Furthermore, one main hypothesis (H1) was formulated to facilitate addressing the first objective of the research (see [Section 4.1.3](#)).

##### 2. Result of the Safety Culture Survey:

The survey questionnaire was first assessed, validated and reconstructed using Exploratory Factor Analysis of the SPSS tool. It yielded in the extraction of eight factors: Top management commitment, safety management system, safety-related human resources, local management involvement, crew psychological safety, crew job satisfaction, external supervision pressure, and crew safety behavior.

The correlation analysis showed that local management involvement and crew safety behavior are highly correlated with the overall safety culture level. Therefore, they represented reliable predictors and indicators of positive safety culture level.

Furthermore, the correlation analysis resulted in high correlation between local management involvement and crew safety behavior and the crew psychological safety, and between the safety management system and the crew safety behavior. However, the results showed no significant correlation between the external supervision pressure and all the remaining seven factors.

The comparative analysis of safety culture factors concluded that there are statistically significant differences between the extracted safety culture factors in ocean-going and domestic ships, except for the crew psychological safety and the perceived pressure introduced by external supervisions. In particular, the results showed a significant difference in the top management commitment towards safety. Therefore, the research statistically supported the main hypothesis H1 that, *“the organizational culture affects safety culture and results in subcultures of safety in the same organization, even with the same employees with the same qualifications”*.

Then, to investigate the mechanism by which the organizational management of safety affect safety culture, the research conducted linear and moderated regression analyses, resulting in constructing a safety culture model as proposed by [Figure 12](#). In particular, it was found that:

- a. The top management commitment and the safety management system moderate the impact of local management involvement on crew safety behavior.
- b. Safety-related human resource increases the impact of the crew job satisfaction and the crew psychological safety on the crew safety behavior.

The next chapter discusses in depth the study’s findings and limitations and aligns them with the literature. In addition, it provides conclusion and recommendations for further research.

## CHAPTER 5: DISCUSSION AND CONCLUSION

This chapter provides a summary of the study, a discussion of the findings and conclusion, as well as the limitations and recommendations for future research.

### 5.1. Summary of the Study

This study investigated the existence of different subcultures of safety as a result of the existence of different organizational subcultures in the same shipping company. To achieve this aim, a case study of an Algerian shipping company operating both ocean-going and domestic ships with the same seafarers was examined. Three research objectives were outlined to help achieve the main aim of the study:

1. Identifying the key elements associated with safety culture that influence safety of both ocean-going and domestic ships.
2. Examining the existence of different subcultures of safety as a result of the existence of different organizational subcultures.
3. Investigating the influences of the organizational factors on safety culture onboard both ocean-going and domestic ships.

To conduct this research, an exploratory mixed method was applied. The qualitative data collection part, consisting of six semi-structured interviews with maritime experts (see [section 3.4.1](#)), explored the research topic and assisted in designing the questionnaire of safety culture measurement. The survey questionnaire served for quantitatively collecting seafarers' perceptions regarding different aspects related to safety culture onboard ocean-going and domestic ships in Algeria. The first research objective was achieved through analyzing the content of the interviews and conducting an exploratory factor analysis and a correlation analysis of the quantitative data. While the second research objective was achieved through comparative analysis

and hypotheses testing, the third objective utilized regression analysis (see Figure 8). The study findings are discussed next.

## 5.2. Discussion of the Findings

As mentioned above, the study included three research objectives. The first and the third research objectives involved answering research questions, while the second research objective consisted of verifying a research hypothesis.

### Research Objective One

*“Identifying the key elements that influence safety culture of both ocean-going and domestic ships.*

**Research question (Q1):** *What are the factors influencing safety within international and domestic shipping activities and bearing on safety culture.*

To answer research question Q1, both qualitative and quantitative data analyses were utilized. Content analysis of the interviews yielded a classification of the factors associated with safety culture that impact safety of both ocean-going and domestic ships in four main categories: organizational safety management included two themes; shipboard safety climate included eleven themes; job satisfaction included one theme; and pressure and stress on board ships included two themes (see [section 4.1.1](#)).

Supported by the literature of safety culture assessment and based on the details of interviews analysis themes, a measurement tool of safety culture was developed. It covered different topics suggested having a link to safety culture (Appendix B : Safety Culture Survey Questionnaire refers), the exploratory factor analysis of the quantitative data using the SPSS tool resulted in the extraction of eight factors: (1) top management commitment, (2) safety management system, (3) safety-related human resources, (4) local management involvement, (5) crew psychological safety, (6) crew job satisfaction, (7) external supervision pressure, and (8) crew safety behavior.



Subsequently, to statistically answer the research question, a correlation analysis of the eight safety culture factors was conducted. The results showed that all the safety culture factors, except external supervision pressure, were highly correlated with the overall safety culture. The correlation analysis results led to state, as an answer to the research question (Q1), that the above highlighted factors, except the external supervision pressure, are key elements extremely linked to safety culture of both ocean-going and domestic ships. Furthermore, they could be considered highly reliable predictors and indicators of safety culture of ocean-going and domestic ships.

These findings, regarding the key elements associated with and affecting safety culture, supported the statement given by Steve, Felin and Murdey (2007) when they indicated that the organization's commitment and workforce involvement are the only two factors replicated across studies. Furthermore, these research findings are, to a large extent, in line with several previous studies. For instance, in this study, crew job satisfaction and crew psychological safety showed significant influence on safety culture and were similarly found by some other studies. Specifically, the literature refers to these factors as psychological well-being and considers it as a critical dimension that influences both safety and work efficiency within safety-critical organizations, such as the shipping industry (Alagaraja, 2020; der Kinderen et al., 2020; Bergheim et al., 2015).

The alignments of the findings regarding safety culture dimensions were found in separate studies; however, this study contributed to the safety culture measurement by combining these dimensions (i.e., factors) under one umbrella. This may result in a comprehensive understanding of how these dimensions influence each other and affect the overall safety culture.

### Research Objective Two

*“Examining the existence of different subcultures of safety as a result of the existence of different organizational subcultures.”*

***Hypothesis (H1): the organizational subculture affects safety culture and results in respective subcultures of safety in the same organization, even with the same employees with the same qualifications.***

This research objective was addressed through statistical analysis of the quantitative data. However, the qualitative part also served to achieve this research objective. Indeed, personal interviews were conducted to also investigate the differences regarding safety culture between the two shipping companies' activities (i.e., international and domestic shipping). The analysis of the interviews showed a high likelihood of the existence of different safety subcultures as a result of the different organizational subcultures. To facilitate addressing statistically this second research objective, the researcher formulated the hypothesis (H1) mentioned above.

To test this hypothesis, the researcher conducted a comparative analysis. The purpose was to investigate whether there are significant differences in safety culture between ocean-going and domestic ships. The analysis statistically compared the mean values of each safety culture factor between the two types of ships. The results provided evidence that there are significant differences in all the compared safety culture factors between ocean-going and domestic ships, except for external supervision pressure and crew psychological safety. This fact led to support the hypothesis that organizational subcultures affect safety culture and result in subcultures of safety in the same organization even with the same employees with the same qualifications.

Thus, regarding the second research objective, the study findings statistically confirmed that the existence of different organizational subcultures in the same shipping company affects safety culture and results in respective subcultures of safety on board ships, even with the same employees with the same qualifications.

Additionally, the research findings showed that external supervision, such as Port State Control (PSC), Flag State Control (FSC), and other external safety supervisions have marginal relationship with safety culture onboard ships. It was also found that crew psychological safety does not differ between ocean-going and

domestic ships. Apropos this last finding, the research suggests that the fact of maintaining the same score of psychological safety between the two types of ships in the same organization is probably linked to the fact that all the participants belong to the same national culture. Given the fact that psychological safety at the workplace depends largely on the interactions within the teamwork, including teamwork cohesion, trust, leaders' authority style, and the relationship between the superiors and followers, this last finding support Hofstede's model dimensions: power distance, collectivism versus individualism, and uncertainty avoidance index (see [section 2.2.3.2](#)), the findings support Hofstede's (2011) statement that the cultural model's dimensions are preserved in organizations when operating within the same national culture.

### Research Objective Three

*"Investigating the way by which the shipping company' management of safety can improve safety culture of domestic ships and align it with the one of the ocean-going ships."*

**Research question (Q2):** *In what way does a shipping company management<sup>7</sup> of safety contribute to a difference in safety culture between its different divisions such as for example, international and domestic shipping divisions?*

The research question Q2 related to the third research objective was investigated through regression analysis of the quantitative data. Linear regression analyses were first performed to define the influence direction of each factor of safety culture on the other factors. It was found that the organizational factors, including top management commitment, safety management system, and safety-related human resources, influence each other and at the same time affect the shipboard safety climate factors, including crew job satisfaction, crew psychological safety, local management involvement, and crew safety behavior. Additionally, it was found that local

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<sup>7</sup> According to ISO-9001, management refers to the control of resources, and other aspects of the organization that require monitoring.

management involvement and crew job satisfaction have a significant influence on crew safety behavior.

Moreover, to answer the research question and properly address this third objective, the study investigated further the influence of the organizational factors (i.e., top management commitment, safety management system, and safety-related human resources) on the shipboard safety climate factors. For this purpose, a moderated regression analysis was conducted. The results of this regression analysis indicated the following:

In addition to the direct influence of the organizational factors on each other and each factor of the shipboard safety climate:

1. Top management commitment and safety management system moderate the impact of local management involvement on crew safety behavior. This means that the failure in the local management involvement can be compensated by a top management commitment and adequate and effective safety management system; however,
2. Safety-related human resource increases the impact of the crew job satisfaction and the crew psychological safety on the crew safety behavior. This means that people with a high qualification are more vulnerable to the impact of their job dissatisfaction and the environment of low psychological safety. This fact led to conclude that shipping companies should take into consideration crew members' qualifications, their job satisfaction and the shipboard psychological safety environment to ensure a high level of crew safety behavior. Specifically, for shipping companies operating ocean-going and domestic ships, considering the seafarers' qualifications when manning the ships is of prime importance to ensure an optimal level of job satisfaction and adequate psychological safety.

Part of the findings of this third research objective is in line with other studies. In fact, several studies indicated that the organizational factors, including the organizational management commitment and prioritization of safety, significantly influence the employees' motivation and striving for success, and this fact may impact

the employees' involvement in safety that would affect, in turn, the safety culture level, e.g., Li et al. (2021); Nurcholis & Qurniawati (2020); Ang-Jun et al. (2018); Horwitz (2017); Cavus and Gokcen (2015). However, this study, by introducing the moderation effect of the organizational factors, provided a comprehensive overview regarding the mechanisms by which the organizational factors affect safety culture. Furthermore, the study culminated in developing a safety culture model (see **Figure 12**). The model can be used in practice for improving the safety culture of both ocean-going and domestic ships.

### 5.3. Conclusion

This study was triggered by a question found in the literature regarding how organizational subcultures affect safety cultures in organizations. The reviewed literature seemed to have no clear answer. Relevant literature covering organizational culture and safety culture, including safety culture in shipping, provided a theoretical framework for the study. Then, the researcher carried out a case study of international versus domestic shipping activities in Algeria. Specifically, the study targeted shipping companies operating both ocean-going and domestic ships. Seafarers in both types of ships have the same qualification required by the STCW Convention, and in most cases, they work interchangeably between these types of ships. The starting point was that the organizational cultures in managing these two types of activities are supposed to be different in the same shipping companies (i.e., two different organizational subcultures). To investigate the impact of this fact on safety culture, the study applied an exploratory mixed method. The exploratory part consisted of six interviews with maritime professionals who have abundant experience in working closely with both types of ships (i.e., two Master, two Chief Engineers, one ISM Code auditor, and one classification society inspector). This exploratory study provided relevant information regarding the managerial and the shipboard's attitudes, behaviors, and practices associated with different aspects of safety culture, such as prioritization of safety, safety management system, training, documentation, communication, safety participation, and safety compliance. The interviews analysis results assisted the research in constructing the safety measurement tools and formulate a hypothesis (H1:

the organizational subculture affects safety culture and results in respective subcultures of safety in the same organization, even with the same employees with the same qualification). The measurement tool aimed to collect seafarers' perceptions regarding different aspects of safety culture. Thus, the objectives of the research and the validation of the hypothesis were achieved by analyzing statistically the questionnaire data collected.

First, the study identified seven key elements affecting safety culture onboard ocean-going and domestic ships in the same company: top management commitment, safety management system, safety-related human resource, local management involvement, crew psychological safety, crew job satisfaction, a crew safety behavior. External supervision, such as Port and Flag State controls has shown weak influence on safety culture in comparison to the seven aforementioned elements.

Second, the study concluded that different organizational cultures will result in differing safety cultures. In other words, organizational subcultures result in safety subcultures in the same organization, even with the same people.

Third, in investigating the way the organizational culture affects safety culture, it was found that the organizational factors relative to the management of safety, including top management commitment, safety human resource, and safety management system affect each other and the shipload's safety climate, including local management commitment, crew job satisfaction, crew psychological safety, and crew safety behavior. It was also found that the organizational factors influence or moderate the impact of the shipboard's safety climate factors on each other. According to the last findings, it was concluded that the shipping companies, operating both ocean-going and domestic ships, should take into consideration together with the qualification of seafarers and their job satisfaction when manning ships to ensure an optimal level of safety culture. Furthermore, it was found that the interaction between the local management involvement and company management of safety (i.e., top management commitment and safety management system) impacts crew safety behavior. Specifically, good local management involvement can compensate for the

failure in the organizational factors as well as the failure in the local management commitment can be compensated by the organizational factors.

#### 5.4. Limitations and Recommendations for Future Research

Like any other study, this study involved some strengths and limitations. In this study, the measurement tool was constructed based on an exploratory survey, the next step should include a statistical examination of the structure of the instrument's factors through confirmatory factor analysis. The strength of this study was that the findings were based on objective data. In fact, the interviewees were carefully selected and a quantitative data was collected from a sample of 373 seafarers. Then, the findings were obtained using a mixed-method, through content analysis of the interviews and statistical analysis of the quantitative data (i.e., questionnaire data). However, there were some limitations of the study. For instance, the number of shipping companies operating both ocean-going and domestic ships was small, with only two companies.

Also, an inherent limitation of survey research was the inability to investigate for more deep information based on the self-reported responses. In this concern, the researcher recognized that seafarers may not always report the real perceptions, believes, opinions, and feelings existed in practice, regarding the question asked about safety culture aspects. Thus, further research should involve qualitative data methods based on structured interviews or focus groups with seafarers. Also, close observations and audits may contribute to collect more precise data. Indeed, it is easier for the researcher to observe safety behaviors than to measure safety-related attitudes, values, and beliefs.

Regarding the outcomes of this study, the findings related to the moderation effect are of prime importance and can feed other studies concerned with the modeling and the optimization of the maritime safety culture; in this context, further research is recommended to develop and exploit these findings.

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## Appendices

### Appendix A: WMU Research Ethics Committee Protocol



#### WMU Research Ethics Committee Protocol

Name of principal researcher:	KAHLOUCHE Nadhir
Name(s) of any co-researcher(s):	None
If applicable, for which degree is each researcher registered?	Maritime Safety and Environmental Administration
Name of supervisor, if any:	Dr. Anish Hebbar
Title of project:	Assessment of Safety Culture in Shipping – Case Study of Algeria.
Is the research funded externally?	No
If so, by which agency?	No
Where will the research be carried out?	The research will be carried out in Sweden. The participants would be from Algeria.
How will the participants be recruited?	The participants will be recruited by email on a voluntary basis.
How many participants will take part?	Around 200 participants
Will they be paid?	No
If so, please supply details:	No
How will the research data be collected (by interview, by questionnaires, etc.)?	The research data will be collected by questionnaire and personal interviews.
How will the research data be stored?	The research data will be stored on my personal computer with protected passwords.
How and when will the research data be disposed of?	All the research data will be deleted from my PC by the end of my MSC degree (31 October 2021).
Is a risk assessment necessary? If so, please attach	No

Signature(s) of Researcher(s):  Date: 21-05-2021

Signature of Supervisor:  Date: 21 May 2021

Please attach:

- A copy of the research proposal
- A copy of any risk assessment
- A copy of the consent form to be given to participants
- A copy of the information sheet to be given to participants
- A copy of any item used to recruit participants

## Appendix B : Safety Culture Survey Questionnaire

### Consent Form

#### Dear Participant

In this survey I want to assess how safety is handled on board ships in Algeria and how the crew perceives safety. This is part of my Master's dissertation at the World Maritime University (WMU), which aims to improve our understanding of how various safety-related aspects work in practice. The dissertation research is being undertaken under the supervision of Dr Anish Hebbar, Assistant Professor MSEA and he can be reached at [ah@wmu.se](mailto:ah@wmu.se)

This questionnaire includes five sections. In each section, the participant is invited to answer a range question, as per the scale indicated. All the information obtained through the survey is **anonymous**. There will not be any possibility to trace any answers to the individuals, companies or vessels. As a WMU student, my work will be carried out in line with the World Maritime University (WMU) guidelines for research ethics, which among other things protect your right to be anonymous. Only I will handle the completed forms or have other access to the data.

To optimise the quality of the survey, it is important that as many people as possible complete the form. It will take about 25 minutes to complete the form. It is also important that the questions are answered as frankly as possible. When you have completed the paper format of the questionnaire, kindly deliver it to the chosen contact person onboard for this survey. If you have chosen the electronic format, kindly return the filled-in questionnaire to the undersigned at [kah.nadiro@gmail.com](mailto:kah.nadiro@gmail.com)

- As regards the answering of the questions on the form itself, please relate your answers to the circumstance on board this particular vessel.
- As regards comments and suggestions for improvements, you can relate these to the experience you have in shipping in general.

If you have any questions, comments or suggestions regarding this survey, feel free to contact me, KAHLOUCHE Nadhir, at [kah.nadiro@gmail.com](mailto:kah.nadiro@gmail.com), or by WhatsApp/ Viber no. (+213) 774465167.

Thank you very much in advance for taking the time to fill in the questionnaire!

Yours sincerely,

Nadhir.

**Participant Background and Information:**

1. Gender: Female/ Male
2. Age: Under 25 years / 25-30 years / 36-45 years /46 – 55 years / Above 56 years
3. My ship sails in: International waters/ National waters •
4. My company is:
5. How long have you been working for this company: less than 5 years/ 5-10 years/ 11-15 years/16-20 years/ More than 20 years
6. How long have you been working in shipping? less than 5 years/ 5-10 years/ 11-15 years/16-20 years/ More than 20 years
7. Which kind of employment contract do you have? Permanent contract / Temporary contact
8. My position/rank on board: Officer-Deck Department/ Officer-Engine Department/ Seaman-Deck department/Seaman-Engine department/ Cratering/Hotel Department.

Please read the statement below and circle the letter of your answer.	Strongly disagree: A	Disagree: B	Neutral: C	Agree: D	Strongly agree: F
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SECTION 1: Organizational Safety Management					
01	The top management ashore in my company prioritizes safety over commercial operations.	A	B	C	D E
02	We do not get clear information about incidents that happen on board other vessels of the company.	A	B	C	D E
03	The shipboard management receives positive feedback when raising safety issues to the company management.	A	B	C	D E
04	The punishment for violating the company's safety rules is fair.	A	B	C	D E
05	Here, we see improvements before something has gone wrong.	A	B	C	D E
SECTION 2: The Shipboard Safety Climate					
06	The captain can say "stop"/"time out" to the company if the safety of the crew onboard is threatened.	A	B	C	D E
07	My immediate superior onboard does not care how we do our work as long as the work gets done.	A	B	C	D E
08	I voluntarily carry out some activities that I assume it can improve safety on board my ship.	A	B	C	D E
09	We receive adequate safety-related information when we sign on / start a new sailing period.	A	B	C	D E
10	To cover mistakes, undesirable incidents onboard are "fixed up" and not reported.	A	B	C	D E
11	Minor incidents are not reported in writing on my vessel.	A	B	C	D E
12	I report my mistakes in work to my superior without any fear of punishment or blame.	A	B	C	D E
13	I have to violate procedures due to the company or the superiors' demand for efficiency of work.	A	B	C	D E

14	We carry out a “Safe Job/ Risk Analysis” before high-risk operations or new working methods/ tools are introduced.	A	B	C	D	E
15	The crew members do not care about the use of protective equipment in location where and when it is mandatory	A	B	C	D	E
16	I can tell the captain to” stop”/” time out” if we feel that safety is threatened	A	B	C	D	E
17	The procedures in the safety management system (SMS) of my company are clear and helpful in my work.	A	B	C	D	E
18	The training received is not fully relevant in practice to work safely on-board vessels.	A	B	C	D	E
19	The training received is not sufficient to handle critical or hazardous situations on board vessels.	A	B	C	D	E
20	The size of crew on board this vessel is not adequate to ensure both, timely work and safety.	A	B	C	D	E
21	To get the work done, I have to work overtime, at the cost of my hours of rest.	A	B	C	D	E
22	I don’t feel sufficiently rested to carry out my tasks in a safe manner on my shift.	A	B	C	D	E
23	I am unable to participate in the safety meetings onboard due to the workload onboard.	A	B	C	D	E
24	The current working situation onboard is less physically challenging than a couple of years ago.	A	B	C	D	E
25	The safety documentation we need is available and up to date onboard.	A	B	C	D	E
26	To perform the work safely, the documentation language used onboard is well understood by all the users.	A	B	C	D	E
27	Every new crew member gets a thorough introduction to safety-related issues.	A	B	C	D	E
28	The work here, apart from the watch duties, is performed individually.	A	B	C	D	E
29	We solve problems and conflicts between the crew members in a good manner.	A	B	C	D	E
30	The team discusses and communicates effectively about work and safety.	A	B	C	D	E
31	My immediate superior is not afraid of admitting his own mistakes.	A	B	C	D	E
32	My immediate superior has very little confidence in his co-workers.	A	B	C	D	E
33	My co-workers avoid asking for help in work so as to avoid looking incompetent.	A	B	C	D	E
34	I enjoy my job.	A	B	C	D	E
35	This company is a good employer compared to others.	A	B	C	D	E
36	I am not satisfied with my salary in this company.	A	B	C	D	E
37	I feel satisfied regarding the promotion in my career in this company.	A	B	C	D	E
38	I care more about not losing my job.	A	B	C	D	E
39	I do not feel appreciated by my superiors and co-workers onboard.	A	B	C	D	E

<b>SECTION 3: Pressure and Stress on Board ships</b>					
40	The current working situation onboard is less stressful than a couple of years ago.	A	B	C	D E
41	Being away from my family for a long time, for me, it is not a source of stress	A	B	C	D E
42	For me, my work on board at sea itself is a source of stress.	A	B	C	D E
43	The inspection carried out by the port state introduces an extra pressure and stress on the crew.	A	B	C	D E
44	Inspections and audits carried out by flag state or delegated organisms introduce an extra pressure and stress on crew.	A	B	C	D E
45	External safety inspection or audit carried onboard have on relation with the crew's stress.	A	B	C	D E
46	During this pandemic period, I have experienced more stress onboard.	A	B	C	D E

## Appendix C: Personal Interviews



### Interview Consent Form

Dear Participant,

Thank you for agreeing to participate in this research survey, which is carried out in connection with a Dissertation which will be written by the interviewer, in partial fulfilment of the requirements for the degree of Master of Science in Maritime Affairs at the World Maritime University in Malmo, Sweden.

The topic of the Dissertation is: Organizational subcultures and Safety Culture in Shipping- Case study of Algeria.

The information provided by you in this interview will be used for research purposes and the results will form part of a dissertation, which will be published online and made available to the public. Your personal information will not be published. You may withdraw from the research at any time, and your personal data will be immediately deleted.

Anonymised research data will be archived on a secure virtual drive linked to a World Maritime University email address. All the data will be deleted as soon as the degree is awarded.

Your participation in the interview is highly appreciated.

Student's name	KAHLOUCHE Nadhir.
Specialization	Maritime Safety and Environmental Administration (MSEA).
Email address	w1802448@wmu.se

\* \* \*

I consent to my personal data, as outlined above, being used for this study. I understand that all personal data relating to participants is held and processed in the strictest confidence, and will be deleted at the end of the researcher's enrolment.

Name: .....

Signature: .....

Date: .....

**Quotation Agreement:**

I also understand that my words may be quoted directly. With regards to being quoted, please initial next to any of the statements that you agree with:

	I wish to review the notes, transcripts, or other data collected during the research pertaining to my participation.
	I agree to be quoted directly.
	I agree to be quoted directly if my name is not published and a made-up name (pseudonym) is used.
	I agree that the researchers may publish documents that contain quotations by me.

By signing this form, I agree that;

I am voluntarily taking part in this project. I understand that I don't have to take part, and I can stop the interview at any time;

The transcribed interview or extracts from it may be used as described above;

I have read the Information sheet;

I don't expect to receive any benefit or payment for my participation;

I can request a copy of the transcript of my interview and may make edits;

I have been able to ask any questions I might have, and I understand that I am free to contact the researcher with any questions I may have in the future.

Participant's name and signature:

Date:

**Contact Information:**

This research has been reviewed and approved by the World Maritime University Research Ethics Committee. If you have any additional questions or concerns about this project, please contact:

Student's name: KAHLOUCHE Nadhir

Specialization: Maritime Safety and Environmental Administration (MSEA).

E-mail: w1802448@wmu.se

You can also contact research supervisor:

Supervisor's name: Dr. Anish Hebbar

Position: Assistant Professor, MSEA

E-mail : ah@wmu.se

## **Interview Questions**

### **Personnel information:**

Name of participant:

Company or institution:

Position:

Year of experience:

According to the interviewee's background, the questions asked to each participant were selected from the following list:

1. In your opinion, what are the main differences regarding safety culture between ocean-going and domestic ships?
2. How do you handle crew members, onboard ocean-going and domestic ships, who do not follow safety regulations? Do you take care about their job security for example because of the punishment consequences?
3. Do you face usually conflicting requirement from the company /captains/superiors to do the work efficiently against the safety of the crew on board? Are there differences between ocean-going and domestic ships in this matter? What do you do to resolve this conflict?
4. What do you think is the most stressful on-board ocean-going and domestic ships?
5. What are the challenges that face shipping companies operating both type of ships to have the same safety culture on board ships, whatever, ocean-going or domestic?
6. How can the organization management of safety be responsible for creating differences in safety culture on board ships?
7. What qualities do you think are important in a captain and chief engineer position as manager and leaders on board ships?
8. For the top management in the shipping company, what is the most important indicator that can be used to determine whether companies have safety culture issues on board their ships before an accident occurs?
9. If management commitment in shipping is fully behind safety culture change and enhancement on board their ships to prevent accidents, how likely is this management to succeed in practice?
10. If you had to say, in your opinion, what is the most important ingredient or secret in the positive safety culture change, especially in shipping? Please elaborate.



11. When evaluating the effectiveness of the company safety management system on board ships, in your opinion, which are the most criteria to define this success and how can you measure it?
12. What do you believe is an area that can be used (in the training for example) to help seafarer becomes aware about safety?
13. What is the biggest challenge to ensure a positive safety culture change in shipping? And specifically in domestic shipping? Please elaborate.
14. What are the most important factors of the human element that shipping companies need to address to ensure a just safety culture on board their ships? Please elaborate.
15. In your opinion, in Shipping, is safety and culture change expensive? Could you elaborate your opinion please?

## Appendix D: The Construction of the Survey Questionnaire

Category	Theme	Related Questions
Organization Management of Safety	Prioritizing safety over commercial operation	Q1
	Proactive approach in improving safety	Q2- Q3- Q4- Q5
Shipboard Safety Climate	Master and superiors' prioritization of safety	Q6- Q7
	Reporting system	Q10- Q11- Q12
	Safety Behavior	Q8- Q9- Q13- Q14- Q15- Q16
	Effectiveness of the SMS's procedures	Q17- Q27
	Adequacy of safety training	Q18- Q19
	Adequacy of safe manning level	Q20
	Tradeoff between work efficiency and Safety.	Q21- Q23
	Fatigue	Q22- Q24
	Adequacy of documentation	Q25- Q26
	Teamwork environment	Q28- Q29
	Safety communication	Q30- Q31- Q32- Q33
Job satisfaction	Job satisfaction	Q34- Q35- Q36- Q37- Q38- Q39
Pressure and Stress on board ships	Pressure of external safety supervisions	Q43- Q44- Q45
	Other stressors on board ships	Q40- Q41- Q42- Q46

## Appendix E: Reconstruction of the questionnaire according to the Exploratory Factor Analysis

### Safety Culture Survey (alpha- 0.921)

<b>Top Management Commitment (TMC) (Alpha - 0.764; Eigenvalues 2.042; % of variance= 68.069)</b>	<b>Loading</b>
Q1. The top management ashore in my company prioritizes safety over commercial operations.	0.845
Q3. The shipboard management receives positive feedback when they raise safety issues to the company management.	0.821
Q5. Here, we see improvements before something has gone wrong.	0.808
<b>Safety Management System (SMS) (alpha- 0.782; Eigenvalues 2.687; % of variance= 53.749)</b>	
Q25. The safety documentation we need is available and up to date onboard.	0.610
Q26. To perform the work safely, the documentation language used onboard is well understood by all the users.	0.576
Q9. We receive adequate safety-related information when we sign on / start a new sailing period.	0.616
Q17. The procedures in the safety management system (SMS) of my company are clear and helpful in my work.	0.585
Q27. Every new crew member gets a thorough introduction to safety-related issues.	0.728
<b>Safety Human Resources (SHR) (alpha- 0.749; Eigenvalues 2.025, % of variance 67.541)</b>	
Q18. The training received is not fully relevant in practice to work safely on-board vessels. (inversed)	0.882
Q19. The training received is not sufficient to handle critical or hazardous situations on board vessels. (inversed)	0.896
Q20. The size of crew on board this vessel is not adequate to ensure both, timely work and safety. (Inversed)	0.666
<b>Local Management Involvement (LMI) (alpha- 0.770; Eigenvalues 2.780, % of variance 46.337)</b>	
Q4. The punishment for violating company safety rules is not fair. (inversed)	0.579
Q6. The captain can say "stop" / "time out" to the company if the safety of the crew onboard is threatened.	0.612
Q7. My immediate superior onboard does not care how we do our work as long as the work gets done. (inversed)	0.739
Q11. Minor incidents are not reported in writing on my vessel. (inversed)	0.721
Q23. I am unable to participate in the safety meetings onboard due to the workload onboard. (inversed)	0.630
Q10. To cover mistakes, undesirable incidents onboard are "fixed up" and not reported. (inversed)	0.779
<b>Crew Psychological safety (CPS) (alpha- 0.747; Eigenvalues 2.692, % of variance 44.865)</b>	
Q29. We solve problems and conflicts between the crew members in a good manner.	0.631
Q30. The team discusses and communicates effectively about work and safety.	0.764
Q31. My immediate superior is not afraid of admitting his own mistakes.	0.728

Q32. My immediate superior has very little confidence in his co-workers. (inversed)	0.675
Q33. My co-workers avoid asking for help in work so as to avoid looking incompetent. (inversed)	0.627
Q39. I do not feel appreciated by my superiors and co-workers onboard. (inversed)	0.577
<b>Crew Safety Behavior (CSB)(alpha- 0.711; Eigenvalues 2.478, % of variance 41.301)</b>	
Q13. I have to violate procedures due to the company or the superiors 'demand for efficiency of work. (inversed)	0.720
Q14. I carry out a "Safe Job/ Risk Analysis" before high-risk operations or new working methods/ tools are introduced.	0.741
Q15 The crew members do not care about the use of required protective equipment where and when it is mandatory (inversed)	0.637
Q8. I voluntary carry out some activities that I assume it can improve safety on board my ship.	0.513
Q16. I tell the captain to" stop"/" time out" if I feel that safety is threatened	0.660
Q12. I report my mistakes in work to my superior without any fear of punishment or blame.	0.553
<b>Job Satisfaction (alpha- 0.678; Eigenvalues 2.104, % of variance 42.082)</b>	
Q34. I enjoy my job.	0.525
Q35. This company is a good employer compared to others.	0.745
Q36. I am not satisfied with my salary in this company.	0.493
Q37. I feel satisfied regarding the promotion in my career in this company.	0.654
Q38. I am not satisfied with the work conditions on board.	0.776
<b>External Supervision Pressure (ESP) (alpha- 0.806; Eigenvalues 1.909, % of variance 63.631)</b>	
Q43. The inspection carried out by the port state introduces an extra pressure and stress on the crew.	0.859
Q44. Inspections and audits carried out by flag state or delegated organisms introduce an extra pressure and stress on the crew.	0.811
Q45. External safety inspection or audit carried onboard have no relation with the crew's stress (inversed)	0.716

#### **Remaining questions (not considered in any section due to reliability issues)**

- Q24. The current working situation onboard is less physically challenging than a couple of years ago
- Q40. The current working situation onboard is less stressful than a couple of years ago.
- Q21. To get the work done, I have to work overtime, at the cost of my hours of rest. (inversed)
- Q22. I don't feel sufficiently rested to carry out my tasks in a safe manner on my shift. (inversed)
- Q28. The work here, apart from the watch duties, is performed individually.
- Q41. Being away from my family for a long time, for me, it is not a source of stress
- Q42. For me, my work on board at sea itself is a source of stress.
- Q46. During this pandemic period, I have experienced more stress onboard.
- Q2. We do not get clear information about incidents that happen on board other vessels of the company.