

Maritime social sustainability: Conceptualization and scale development

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ABSTRACT

The maritime transportation sector has been actively encouraging economic, environmental, and social sustainability. However, academic research on maritime social sustainability is still limited.

This study provides a comprehensive conceptualization of maritime social responsibility and investigates whether the flag of the vessel, impacts this conceptualization.

Using data from many seafarers globally, the present study empirically confirms and validates that maritime social responsibility is a multidimensional construct, consisting of (i) physical, (ii) functional, (iii) healthy, (iv) cultural, and (v) communication components. Findings show that seafarers' perceptions do not differ based on the flag of the vessel of their employment.

The present study offers valuable insight to understand maritime social sustainability and extends the literature on the linkage between vessel flags and working and living aspects onboard. It provides managerial and policy implications.

1. Introduction

Social sustainability is at the core of Sustainable Development Goals (SDGs) adopted by United Nations (UN) Member States in 2015. Specifically, Goal 3 of the SDGs refers to 'Ensuring healthy lives and promoting well-being for all at all ages' and Goal 8 addresses the 'promotion of inclusive and sustainable economic growth, full and productive employment, and decent work for all'. The maritime industry, representing more than 80 % of worldwide trade and directly impacting many more industries, plays a key role in achieving the UN's SDGs (Wang et al., 2020). The International Maritime Organization (IMO) recognises this pivotal role of maritime and actively promotes the 2030 Agenda for sustainable development, encouraging actors in the shipping industry to enhance their economic, environmental, and social sustainability (IMO, 2017). However, environmental sustainability has attracted most of the attention; despite the significance of social sustainability in the maritime sector, prior studies focused mostly on various aspects of seafarers' well-being, stress, and job satisfaction. Yet, no study has aimed to conceptualise maritime social sustainability (MSS) and develop appropriate scales to measure it, which is the aim of this study.

Previous studies have attempted to measure social sustainability in various, yet inconsistent ways such as well-being and working conditions like occupational health & safety certification, (Kumar and Anbanandam, 2022) necessary infrastructure (Shiau and Liu, 2013), absence of labour violations, and diversity (Govindan et al., 2021). However, the seafaring profession has many characteristics that differentiate it from other jobs ashore (Kim and Jang, 2018). Therefore, research findings from other domains cannot be easily

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transferred to maritime social sustainability. Moreover, vessel flags¹ have gained increased academic attention regarding their association with working or safety aspects on board. For instance, some international flags or flags of convenience (FoC) have been linked to lower safety standards (Li et al., 2014), indicating poor social sustainability. Historically, some international flags have been associated with low-quality working and living standards onboard due to the practice of “flagging-out”, which aims to reduce operating expenses, benefit from lower taxes, and streamline maritime operations (Yin et al., 2018).

In the next section, the relevant literature is reviewed, which shows that sustainability is often conceptualized and measured as (i) sustainable performance, e.g., carbon dioxide (CO₂) emissions for environmental sustainability and well-being for social sustainability and (ii) sustainable operations e.g., green operations and sustainable workplace environment. While measuring social sustainable performance presents significant methodological problems (e.g., employee well-being relates to psychological and emotional state as self-reported by employees), measuring social sustainable operations (working and living conditions) can provide a solid basis for conceptualizing and measuring maritime social sustainability. However, no prior study has attempted to do so, and therefore, this study aims to conceptualize and measure maritime social sustainability for the first time.

The study reviewed the literature and uncovered five components of maritime social sustainability: (i) physical, (ii) functional, (iii) healthy, (iv) communication, and (v) cultural. Then, it conducted a large-scale global survey of seafarers employed in vessels of various flags. Confirmatory data analysis followed up by *t*-test analysis validated the scales and the robustness of the construct across vessel flags (i.e., national vs international flags).

Therefore, the current study makes the following contributions: (i) it provides a comprehensive way to conceptualize maritime social sustainability and to empirically validate it in a large sample of seafarers, (ii) it explores potential differences in the conceptualization of maritime social sustainability among vessel flags, (iii) amidst growing interest for social sustainability, it offers timely insights for shipping companies and policymakers that improves our understanding of maritime social sustainability.

The next session reviews the literature on social sustainability, its conceptualisation and measurement, and develops two research hypotheses regarding (i) its main components and (ii) the effects of the vessel flag. Next, Section 3 presents the methodology, including the research design, the survey, and data analysis. Section 4 presents the findings from the data analysis and discusses its results. The final Section 5 summarizes the main conclusions of the study by discussing key theoretical and managerial implications.

2. Maritime social sustainability

2.1. Maritime social sustainability: Conceptualisation

Sustainability constitutes a new way of thinking that challenges people, companies, industries, and nations to redefine how they operate and define performance. Regarding performance, sustainability implies a fundamental transition from efficiency and profit-seeking towards resource preservation and environmental protection. Further, employee well-being and quality of work life become part of the social sustainability goals. Regarding operations, sustainability implies the use of natural resources in ways that respect the environment; equally, companies should develop their workspaces in ways that protect and develop their people. However, early studies identified three dimensions of sustainability (environmental, social, and economic), yet the focus was the environmental dimension, while the social sustainable performance (employee well-being) and operating conditions (workplace environment) have been largely overlooked. For example, Kumar and Anbanandam (2019) argue that the transportation system sustainability should capture economic development, environmental integrity, and social quality of life, yet they note that social sustainability has received less attention, particularly in developing countries. Jensen et al. (2017) note that there are absent initiatives for social sustainability in the construction sector, Govindan et al. (2021) in multi-tier supply chains, Larimian et al. (2020) in urban planning, Leposa (2020) in marine and coastal tourism.

In the maritime domain too, it is also evident that, despite the growing interest, social sustainability remains relatively under-researched compared to environmental sustainability. For example, Gilek et al. (2021) note that maritime spatial planning research is largely dominated by environmental issues and neglects social sustainability. Pantouvakis and Vlachos (2020) surveyed 308 shipping companies in 2018 and uncovered five sustainability dimensions (environmental resources, environmental impact, environmental compliance, social sustainability, and economic sustainability). Social sustainability in the maritime sector differs from other sectors due to the uniqueness of the seafaring profession. Specifically, seafarers are persons who work in a confined environment and cannot leave their workplace or evacuate it in case of a crisis (Doyle et al., 2016). Seafarers are far from their families and friends for long periods, as well as they live within the same physical environment, during both working and leisure hours, for long periods (Liu et al., 2022). As a result, their family, maritime, and ashore social well-being and sustainability are affected by adverse factors such as working under pressure due to tight time schedules, visiting different time zones during their work, frequent bad weather conditions, increased turnaround time in ports, job stress due to reduction in the number of crew members, social isolation, and limited access ashore resulting from increased security measures at ports (Chung et al., 2017; Exarchopoulos et al., 2018).

There is also a lack of consensus on how maritime social sustainability should be defined and measured. Jensen et al. (2017) argue that there is a misconception of social sustainability, which implies a narrower approach to sustainability. Empirical studies on social

¹ In the present study, the classification of flags as “national” or “international” in general follows the common practice in the terminology of ship registration. Also, the current study considers the international flags that are included in the Paris MoU Whitelist. So, the national flag is a state flag, such as Japan, Greece, Hong Kong, China, Norway etc. The international flag refers to the Marshall Islands, Panama, Bahamas, Bermuda, Cyprus, Malta, Liberia etc.

Table 1
Selected recent and/or influential studies in social sustainability

Social Sustainability dimensions	Method	Studies
<ul style="list-style-type: none"> • External (societal) perspective: Social development (e.g., Equal opportunities, Health & safety), Social growth (e.g. Social capital & network, Accessibility), and Social justice (e.g. Social justice, Engaged government) 	Literature review	Ajmal et al. (2018)
<ul style="list-style-type: none"> • Internal/ companies' perspective: Learning and growth (e.g., Education & training, job security, Employment), Community development (e.g. Good governance, Cultural heritage, Social involvement) and Safety and security (e.g. Labour practices, Fair practices, Health & safety) 	Literature review	Antolín-López et al. (2016)
<ul style="list-style-type: none"> • Employee programs • Occupational health and safety • Human rights • Philanthropy • Volunteerism • Local commitment • Bottom of pyramid • Product responsibility • Quality management • Consumer relations management • Sustainable consumption • Employee health and safety • Equity • Wellness • Well-being from an employee perspective 	Literature review	Amrutha and Geetha (2020)
<ul style="list-style-type: none"> • Employee participation (Employees' initiative to participate, Organisation's encouragement to participate) • Employee cooperation (Employee cooperation encouraged by the organisation, Employees' initiatives to cooperate) • Equal opportunities (Equal compensation opportunities, Equal working conditions) • Employee development • Health and safety (Safety conditions, Health conditions) • External partnership 	Survey in a CSR-committed organization	Staniskiėne and Stankeviciute (2018)
<ul style="list-style-type: none"> • Internal human resources (Employment stability, employment practices, health, safety, and capacity development) • External population (human capital, productive capital and community capital) • Stakeholder participation (information provision and stakeholder influence) • Macro social performance (socio-economic and socio-environmental performance) 	Reverse logistics	Sarkis et al. (2010)
<ul style="list-style-type: none"> • Diversity practices • Safety and health practices • Issues related to labour practices • Societal responsibility • Product responsibility 	Supply chain management	Mani et al. (2018)
<ul style="list-style-type: none"> • Labour equity: Ratio of the average hourly labour cost (including benefits and taxes) to the total compensation package (converted to an hourly measure) for the company's highest paid employee • Healthcare: Ratio of company paid healthcare expenses per employee to the market capitalization per employee • Safety: Ratio of average days not injured to the total days worked (per employee) • Philanthropy: Ratio of charitable contributions to market capitalization 	Supply chains	Hutchins and Sutherland (2008)

sustainability measures report a variety of measures. [Labuschagne et al. \(2005\)](#) assess the sustainable performance of various industries and suggested four-components of social sustainability dimensions: internal human resources practices, external population, stakeholder participation, and macro-social performance. In a similar study, [Kumar and Anbanandam \(2022\)](#) developed an index to assess the environmental and social sustainability performance of the freight transportation industry; social sustainability included the following components: (i) Internal human resources (e.g., Occupational health and safety certification, Continuous learning, development, and improvement), (ii) External population (e.g., promoting cultural diversity at the workplace, Prevent forced and compulsory labour), (iii) Stakeholder participation (e.g., Mutual trust), and (iv) Macro social performance (e.g., Provide indigenous rights to stakeholders and workers, prevent corruption in their business practices). [Shiau and Liu \(2013\)](#) suggest local governments to adopt the following components for transport social sustainability: traffic accidents, mobility for elderly people, remote area infrastructure, and traffic subsidy. [Govindan et al. \(2021\)](#) assessed the social sustainability in supply chains and suggested seven components and several sub-components including (i) Labour (e.g., Child labour, Forced or bonded labour, Low wages), (ii) Female workers (Poor condition of women, Health and safety, Substandard working conditions), (iii) Misconduct and threat (e.g., Verbal and

physical abuse at the workplace, Threats of layoffs), (iv) Community (e.g., Local hiring practices), (v) Employee welfare (e.g., Employee welfare, job security), and General issues (e.g., Discrimination, diversity, labour rights violation, corruption and bribery). Therefore, social sustainability is mostly related to sustainable performance, i.e., employee well-being and less to workplace conditions.

According to ILO, well-being in the workplace relates to all working aspects and the presence of a safe, physical environment of high quality, as well as employees' feelings about their work, the environment, in which they work, the work climate and the organization². In the maritime transportation literature, a recent effort to define seafarers' welfare was made by Exarchopoulos et al. (2018), who states that welfare on board is described as all the needs that are necessary for crew members to be healthy and happy and the relevant statutory procedures which must be set by the maritime industry. This definition includes both elements of well-being (e.g., happiness) and the workplace environment (e.g., statutory procedures). Other definitions also describe seafarers' well-being through different perspectives, such as inter alia perceptions of physical and mental health, avoidance of stress (An et al., 2020; Carotenuto et al., 2013), free from financial exploitation, suicide or repatriations (Exarchopoulos et al., 2018), resilience (Doyle et al., 2016; McVeigh et al., 2018), work environment factors (Nielsen et al., 2013) including habitability in berthing compartments (Matsangas and Shattuck, 2021), vessel design (Ellis, 2009), and medical assistance (Sampson and Ellis, 2020).

2.2. Comparative analysis of social sustainability in maritime and related industries

Since there is not a widely accepted conceptualization of maritime social sustainability, we compared maritime with other industries to explore similarities and differences between maritime social sustainability and the social sustainability of other industries.

Table 1 presents the findings of recent or influential studies on social sustainability conducted in various contexts or summarizes the conclusions of comprehensive literature reviews on the said topic. In addition, Table 2 displays relevant findings of studies conducted in different transport sectors. Despite the existence of similarities in social sustainability dimensions or indicators, e.g. Kumar and Anbanandam (2019, 2022) and Sarkis et al. (2010) who explore the social sustainability dimensions of internal human resources, external population, stakeholder participation and macro social performance it seems that many studies utilize adapted frameworks of social sustainability to account for the specific characteristics of the examined industrial sectors, revealing thus the absence of a consensus on reaching a universal conceptualization, set of dimensions or criteria (Staniskiene and Stankeviciute, 2018).

The complex nature of social sustainability and the need for a multifaceted approach to evaluate this concept are especially pronounced when examining research conducted in the transport sector. For example, Kumar and Anbanandam (2019, 2020, 2022) utilized the dimensions of internal human resources, external population, stakeholder participation and macro social performance (with their respective indicators) in order to assess social sustainability in the freight transport industry, while Al Marzouqi et al. (2020) focused on employee well-being, communication, management support, reward and control system, and training in their study of the airline sector. Stefaniec et al. (2020) examined accessibility and traffic casualties in an inland transportation context and Jayarathna et al. (2022) used a rather wide list of social sustainability indicators in the logistics sector, which inter alia included type of injury and rate of injuries, lost days/time, total number of work-related fatalities and absenteeism. Also, Jasti and Ram (2019) utilized the social sustainability indicators of modal share, percentage of accidents involving buses in the last five years, accessibility of differently-abled (%), social priority (%) and signal priority (%) in a bus public transport context.

These findings imply that many studies attempt to analyse social sustainability considering employee-related aspects besides the general, wider societal indicators (Ajmal et al., 2018), such as those indicators related to mobility and transport for older and disabled people, transport infrastructure in remote areas (Shiau and Liu, 2013), community development and product responsibility (Fernandes et al., 2022), passenger transport, length of transport routes or volunteerism and philanthropy (Antolín-López et al., 2016). These employee-related aspects of social sustainability may be context-specific, reflect the circumstances of specific transport sectors and the study scope ranging, among others, from employee participation, employee cooperation, equal opportunities, employee development, and employee well-being (Al Marzouqi et al., 2020; Staniskiene and Stankeviciute, 2018) to hard indicators, i.e. average hours of training per year per employee, total employees by gender, or total training hours per gender to name a few (Jayarathna et al., 2022).

In line with the stream of literature that uncovers the diversity in social sustainability conceptualization, the present study takes an employee perspective in addressing maritime social sustainability, acknowledging at the same time its subjective nature and the shift to "softer" elements (Staniskiene and Stankeviciute, 2018). Also, the proposed five-factor construct of maritime social sustainability considers the specific characteristics of the seafaring profession.

Seafarers live and work in an isolated confined environment. An isolated confined environment presents characteristics that differentiate it from any other job ashore and may also refer to submarine deployments, working on an offshore oil-drilling platform, expeditions in polar environments, space missions etc. Persons working in the isolated environment of a vessel face a unique set of challenges including limited access to open spaces and private areas, restricted opportunities for leisure activities, extended periods of living and working in the same environment, and prolonged separation from family and friends. (Doyle et al., 2016; Exarchopoulos et al., 2018; Sandal et al., 2006). Although they have the opportunity to use telephone or internet facilities, conditions of access to these facilities may hinder effective communication with their families. Moreover, they socialize and interact with the same people, often of mixed genders or culturally diverse, 24 h per day. All these working characteristics may pose challenges to interpersonal relationships (Sandal et al., 2006). These unique characteristics of the seafaring profession can lead to greater stress (e.g. related to the conditions

² https://www.ilo.org/global/topics/safety-and-health-at-work/areasofwork/workplace-health-promotion-and-well-being/WCMS_118396/lang-en/index.htm.

Table 2
Selected recent studies in social sustainability in transport research

Social Sustainability dimensions	Context	Studies
<ul style="list-style-type: none"> Internal human resources (Opportunities for employment, Worker compensation & stability, Health and safety practices, Training & Development, Employment contract) External population (Contribution to health and education, Security practices, Housing and service infrastructure, Government regulation, Cultural involvement) Stakeholder participation (Collective audience, Selective audience, Stakeholder empowerment, Decision influence potential) Macro social performance (Social-economic performance, Social- environmental performance) 	Freight transportation industry	Kumar and Anbanandam (2019)
<ul style="list-style-type: none"> Internal human resources practices External population practices Stakeholder participation Macro social performance practices 	Freight transportation industry	Kumar and Anbanandam (2022)
<ul style="list-style-type: none"> Internal social sustainability practices (e.g., Equal job opportunity for all, Regular assessment of workers' wages and benefits, Health and safety practices, Workers health insurance) External social sustainability practices (e.g., Contribute to community health and education programs, Provide affordable houses to the workers, Prevention of child and forced labour) Stakeholders participation in sustainability (e.g., Joint sustainability programs with other freight transport organisations, Influence of other transport actors) Macro-social performance (e.g., Contribution to CSR activities, Anti-corruption practices) 	Freight transport industry	Kumar and Anbanandam (2020)
<ul style="list-style-type: none"> Employee well-being (Physical well-being, Emotional well-being, Work-life balance) Communication (Frequency, Depth/ details, Width/ span, Message clarity) Management support (Direct support, Indirect support, Professional advancement, Delegation) Reward and control system (Having an official system, Dependence on psychological contract, System consistency, System fairness) Training (Learning by doing, In-class training, Work assignment) 	Airline	Al Marzouqi et al. (2020)
<ul style="list-style-type: none"> Workforce Human rights Community development Product responsibility 	Logistics transportation sector	Fernandes et al. (2022)
<ul style="list-style-type: none"> Accessibility (Density of highways, railways in operation, and inland waterways) Traffic casualties (Number of deaths and people injured in traffic accidents) 	Inland transportation	Stefaniec et al. (2020)
<ul style="list-style-type: none"> Traffic accidents Mobility and transport for older people and disabled persons Transport infrastructure in remote areas Traffic subsidy in remote areas 	Transport	Shiau and Liu (2013)
<ul style="list-style-type: none"> Equal opportunity Quality of life Social awareness Social justice Culture diversity Social commitment Social Engagement and participation Regional competition Passengers' safety 	Civil aviation	Al Sarrah et al. (2021)
<p>(Note: selected indicators from a more extensive list)</p> <ul style="list-style-type: none"> Modal share % Of accidents involving buses in the last five years Accessibility of differently abled (%) Social priority (%) Signal priority (%) 	Bus public transport	Jasti and Ram (2019)
<ul style="list-style-type: none"> Accessibility Safety Satisfaction Employment 	Railways	Liu and Zhang (2022)
<ul style="list-style-type: none"> Type of injury and rate of injuries Lost days/time Total no of work-related fatalities Absenteeism Occupational diseases 	Logistics sector	Jayarathna et al. (2022)

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Table 2 (continued)

Social Sustainability dimensions	Context	Studies
<ul style="list-style-type: none"> • Total number of employees • Total employees by gender • Average hours of training per year per employee • Training on anti-corruption policies and procedures • Total training hours by gender <p>(Selected indicators from a more extensive list)</p> <ul style="list-style-type: none"> • Passenger transport • Length of transport routes • Employment • Accidents involving injury of death • GHG emissions • Expenditure of households in transport 	Road transport	Stefaniec et al. (2021)

onboard, such as noise and engine vibrations or low sleeping quality, as well as subjective factors, such as those pertaining to seafarers' personality and attitudes towards handling stressful situations), which in turn may result in isolation and fatigue (Carotenuto et al., 2013).

The proposed framework of maritime social sustainability is in line with relevant studies in the transportation literature, which address employees' aspects highlighting their physical and emotional well-being, e.g. Al Marzouqi et al. (2020), but disregards external (societal) or stakeholder perspectives on social sustainability, e.g., Kumar and Anbanandam (2020). The proposed construct is not based on hard social sustainability indicators, as sometimes used in surveys in other transport sectors, e.g., Jasti and Ram (2019); Jayarathna et al. (2022). However, it is constructed to account for employees' perceptions (Staniskiene and Stankeviciute, 2018) and to reflect the restricted environment of a vessel through the five proposed factors: the physical and functional factors to account for the elements of the vessel (as seafarers live and work in the same place for months), the healthy factor to account for health issues related to vessel movement and nutrition, the communication factor to address the opportunities for keeping social relationships with those onshore and the cultural factor to consider multiculturalism onboard.

2.3. Maritime social sustainability: Key components

The above discussion reveals that there is a lack of theoretical agreement on operationalizing maritime social sustainability and an absence of a universal method to assess this concept (Exarchopoulos et al., 2018).

The present study focuses on the working conditions of maritime social sustainability, i.e., measuring the operating/working environment (habitat) that provides the conditions required to achieve socially sustainable performance (seafarer well-being). Measuring well-being at the individual level would require the psychological and emotional assessment of seafarers, which is beyond the scope of this study. Measuring maritime social sustainability from the perspective of the working environment has the advantage that the operationalization can be replicated and validated across different countries and contexts.

Therefore, maritime social sustainability includes the physical and functional components of the environment (vessel), the healthy component, the ease of communication, and the cultural aspects onboard. This conceptualization primarily draws upon the Servicescape literature (Bitner, 1992), which argues that the places, in which employees work are part of their experiences (Parish et al., 2008) and the workplace setting influences employee behaviours and outcomes, such as satisfaction, stress or employee productivity (Ashkanasy et al., 2014; Kim and de Dear, 2012).

In the Servicescape literature, it has been demonstrated that the physical surroundings impact the behaviour of its users (Bitner, 1992). Servicescape refers to physical characteristics, in which people (i.e., employees and customers) function. Environmental factors, such as ambient conditions, space/function elements and signs or symbols are linked with employee behaviours. Ambient conditions refer to environmental elements such as temperature, lighting, level of noise, etc., which directly relate to the five human senses. Some others have expanded this ambient factor to include the taste of food and beverages (Pizam and Tasci, 2019). Spatial layout/ functionality refers to the ways that equipment, or furnishings are arranged, as well as their size and shape, and the spatial relationships among them. More specifically, functionality reflects the extent to which machinery, equipment, and furnishings enable performance and the achievement of goals. Signs communicate about a place to its users (Bitner, 1992); but as they have a functional or cultural role in an environment, considering them as a separate component of Servicescape may be unnecessary (Pizam and Tasci, 2019).

Studies have provided evidence that elements of the Servicescape have various consequences for the employees (Parish et al., 2008), as atmospherics, physical design and décor affect workers (Bitner, 1992; Pizam and Tasci, 2019). For example, in a hospital context, nurses' environmental attitudes to convenience, safety and pleasantness are related to job stress and job satisfaction (Parish et al., 2008; Pizam and Tasci, 2019). Kearney et al. (2023) proved that ambience impacts employee satisfaction in a grocery retail context, while Kim and Jang (2022) demonstrated that employees' perceptions of the physical environment of their break-room (e.g. temperature, air quality, lighting, ease of interaction with their co-workers etc.) influence their engagement and psychological well-being in a hospitality setting. Moreover, Kearney et al. (2023) proposed a holistic physical work environment construct consisting of colour and design, cleanliness and odour, music, lighting and layout in a retail setting. Therefore, the physical components of a

workplace constitute important factors, which are linked with employee-related outcomes (Kim and de Dear, 2012) with relevant studies uncovering the impact of environmental stimuli on employees (Kearney et al., 2023).

Moreover, the social Servicescape literature suggests that within the social environment, social interactions occur that deliver emotions and emotional displays, which then impact human behaviour (Tombs and McColl-Kennedy, 2003). In the same line of thought, some cultural aspects of the Servicescape have also been addressed, placing particular emphasis on multilingual service encounters, linguistic symbols and bilingual personnel (Touchstone et al., 2017). Especially in a vessel setting, disregarding both social and cultural aspects would fail to comprehensively conceptualize maritime social sustainability. Social relationships with family and friends through effective communication (Papachristou et al., 2015), as well as cultural and linguistic aspects onboard (Pauksztat, 2021), have received important attention in the literature that deals with seafarers' experience during a voyage.

The above brief discussion on Servicescape reveals that existing literature lies not only on the "traditional" physical and functional dimensions of an environment, but the focus is also on considering other elements (e.g., taste), as well as on addressing social and cultural elements of Servicescape. The roles that employees perform differ not only in terms of what is required from them but also in terms of the environment in which they work (Parish et al., 2008). Seafarers' work requires spending a significant amount of time in their workplace (i.e., the vessel), as well as specialized knowledge, skills and (in some roles) physical labour. Thus, it can be said that seafarers' work is challenging, as it is done totally in a place (the vessel) and is high role-demanding (both emotionally and physically). Literature has shown that employees who perform demanding roles and spend a significant amount of time in their workplaces form certain perceptions of their environment, which in turn impact their satisfaction (Parish et al., 2008).

Below, the five components of maritime social sustainability as conceptualized in this study are presented in more detail. As elaborated above, this conceptualization considers the main physical and functional components of the workplace, and addresses social and cultural aspects of the working environment, while at the same time, it takes into account the specific characteristics of the vessel environment (e.g., confined workspace, subject to extreme environmental and weather conditions etc.), which differs from other employment settings, such as office environments, hospitals or retail stores.

2.3.1. Physical component

The physical component includes dimensions of the atmosphere, such as lighting, noise, temperature, air quality, and ventilation. Studies conducted in onshore workplace settings have revealed that air quality, the amount of light or the levels of temperature and noise are associated with employee satisfaction (Kim and de Dear, 2012).

Noise, which is the unwanted sound (Turan et al., 2011), can have physiological, mental, and social effects, such as feelings of disturbance or stress reactions, and decreases the quality of life of humans. In a vessel setting, high levels of noise are common and are associated with physical stress onboard (Oldenburg et al., 2009). Seafarers must deal with continuous noise caused by the engines, ship machinery, cargo handling operations, or handling of tools during routine shipboard maintenance (Ellis, 2009). A study conducted on chemical tankers has shown that seafarers are likely to be exposed to high noise levels and, according to daily noise exposure calculations, seafarers working in or in proximity to the engine room are greater than the limit values of noise exposure (Turan et al., 2011). The negative consequences of noise may include annoyance, discomfort, but also hearing loss (Turan et al., 2011).

Also, light in the workplace has an impact on the people working there and should not be ignored (Kuller et al., 2006). Specifically, in a study, it was found that the mood of people improves and reaches its highest level when the lighting is perceived as just right, but when the lighting levels are too high, the mood decreases again (Kuller et al., 2006). The quality of exposure to light influences the mood of seafarers, while it can have various effects on those working in different departments onboard (Ellis, 2009). Thus, the lighting in accommodation areas, cabins or other ship spaces should be considered as being important for seafarers.

Regarding the temperature levels, it should be noted that heat in the workplace can be a physical stressor onboard (Oldenburg et al., 2009). Air quality and ventilation are important areas of concern when considering a built environment (Samet and Spengler, 2003), and, as such, it is reasonable to assume that they need to be considered important dimensions of the atmosphere of a vessel.

2.3.2. Functional component

The functional component onboard addresses the functionality and aesthetics of the environment, as well as cleanliness and hygiene. Research has shown that the qualities of surroundings influence the wellness of employees, while aesthetics also impact people's feelings. The use of effective colour design can have a positive impact on mood (Kuller et al., 2006). Further, pleasantness, as an element of the working environment, and the design of the facilities in which employees work have significant implications for job satisfaction (Parish et al., 2008).

Following the above, the decoration of accommodation and recreational areas should not be ignored. Even though there is little room for modification of space dimensions onboard, aesthetically pleasing environments are related to the well-being of those working on a ship. For example, slight changes in colours or the provision of quality recreational facilities could result in more pleasing areas to live in (Ellis, 2009). Also, cleanliness and hygiene should be considered along with aesthetics, as they may affect employee productivity and satisfaction (Horrevorts et al., 2018). Studies have shown that the provision of recreational facilities onboard could raise the happiness levels of seafarers and that this is something that companies could do to lower the levels of anxiety and depression of seafarers (Sampson and Ellis, 2021).

2.3.3. Healthy component

The healthy component refers to food, nutrition, vibrations caused by the ship's operations and sleeping quality and it is a particularly important factor for confined places, such as that of a vessel, where employees live and work for several months.

The provision of quality food and a nutritious diet is important for seafarers (Fotteler et al., 2018) since they can provide better

health for the crew (Lau and Yip, 2017). The linkages between workplaces and employees' dietary patterns have been addressed in the literature (Quintiliani et al., 2010). In a vessel setting, the provision of safe, fresh and nutritious meals is vital, as seafarers face the risk of chronic diseases due to bad nutrition (Lau and Yip, 2017). In this regard, unhealthy food as well as the lack of proper training of the galley staff onboard constitute major concerns for seafarers (Fotteler et al., 2018). Food issues and beverage quality require considerable attention and thus shipping companies should provide adequate quality food and drinking water to support seafarers' daily lives and fulfil their demands (Lau and Yip, 2017). Thus, food and drinking water of proper quantity, quality, nutritional value, and variety should be included as important elements of the healthy component of maritime social sustainability. Furthermore, vibrations and rolling and pitching of the ship are also issues experienced by seafarers, while poor sleeping quality may lead to fatigue and stress (Ellis, 2009) or long-term ill health.

2.3.4. Communication

Social relationships relate to people's health and well-being. Specifically, social support increases a person's ability to confront stressful situations and refers to a social network's provision of psychological and material resources (Cohen, 2004). Prominent non-work sources of social support are friends and family, which are related to general well-being.

However, seafarers spend a significant amount of time onboard, they are away from their families and friends for long periods, which can harm their morale, reduce their performance, and raise the risk of accidents (Papachristou et al., 2015). Although many seafarers could use telephone or internet facilities, conditions of access to these facilities may vary significantly, making it even more difficult for them to communicate with their families. Noteworthy is the fact that the MLC includes reasonable access to telecommunication services onboard, such as email, Internet and ship-to-shore telephone communications, at a reasonable cost, only as a guideline, which renders effective communication among seafarers and their families a challenging situation (Exarchopoulos et al., 2018). It may seem not surprising that free internet access would make life onboard happier for seafarers (Sampson and Ellis, 2021).

Communication with the spouse is also very important for several reasons, such as to keep relationships among the work-separated couple and life onshore, to strengthen the seafarer's morale, to alleviate fear and stress and to maintain relationships with the children (Thomas et al., 2010). Also, sending texts to family and friends and communicating with them through Skype or email make seafarers happy (Sampson and Ellis, 2021). Thus, the provision of adequate communications, through social media, Skype, Internet accessibility, emails etc. is a way of keeping seafarers close to family and friends and sustaining good relationships with them (Sampson and Ellis, 2021), highlighting once again the significance of the availability of communication onboard as a means to strengthen the well-being of seafarers (Papachristou et al., 2015) and as a way to compensate for the work-related tension experienced onboard ships (Oldenburg and Jensen, 2019; Pauksztat et al., 2022a).

2.3.5. Cultural component

Culture constitutes a rather essential element that impacts the behaviour of individuals, and it defines individuals' cognitive, affective, and behavioural responses to the stimuli in the environment (Hofstede and McCrae, 2016). A multicultural working environment includes employees of diverse ethnicities, nationalities, religions or cultural backgrounds (Pasca and Wagner, 2011) and it should ideally encourage the development of an organizational climate of inclusion and acceptance (Stevens et al., 2008). The cultural element may be more important for people that feel marginalized for ethnic, religious, or other differences from the majority (Pizam and Tasci, 2019). Fostering all-inclusive multicultural environments promotes a sense of inclusion among all employees, evokes feelings of connectedness to one another and leads to the emergence of high-quality relationships in the work environment (Stevens et al., 2008).

In the context of the maritime industry, the need to address the element of multiculturalism onboard is even more evident, as seafarers' multiculturalism is one of the key elements of the industry's universal character. Seafarers develop social interactions with the same people on board, often culturally diverse, all day long. Cultural and linguistic barriers among seafarers of mixed cultures can cause significant problems in understanding (Jensen and Oldenburg, 2020). The presence of a multilingual crew onboard has consequences for informal interactions and communication about work-related problems, with subsequent implications for well-being and safety (Pauksztat, 2021).

Thus, adaptation to a multicultural environment through training in intercultural communication is crucial. Training in cultural diversity helps to identify the psychosocial needs of the multicultural crew and can improve well-being (Jensen and Oldenburg, 2020). Thus, addressing the cultural component is deemed rather important, as the management of different cultures onboard may bring benefits, such as improving crew team cohesion and performance, enhancing communication and increasing the quality and safety of the working environment (Theotokas and Progoulaki, 2007).

Building on the studies that emphasize the stressors emerging from multicultural workplaces for employees and highlight the importance of employees' cultural variability when examining their mental health (Pasca and Wagner, 2011), the cultural component, which concerns seafarers' confidence to interact with their multicultural peers, is part of maritime social sustainability.

Following the above discussion, the following hypothesis is submitted:

Hypothesis 1. Maritime social sustainability is a multidimensional concept, consisting of (i) physical, (ii) functional, (iii) healthy, (iv) communication, and (v) cultural components.

2.4. Flag effects on maritime social sustainability

According to the United Nations Convention on the Law of the Sea (UNCLOS) and specifically to Articles 91 and 92, each ship shall

carry the flag of one State only and has the nationality of the State whose flag it has the right to fly. The rights and obligations of a vessel come from the flag States whose nationality they have. The flag State has the duty to implement and impose international standards, laws and regulations (Zwinge, 2011) and needs to ensure that the ships comply with international law.

Once a flag State has granted nationality to a ship, it must exert its jurisdiction and control in administrative, technical, and social aspects and must adopt all the necessary measures to ensure safety at sea (Article 94, UNCLOS). These measures concern, inter alia, the seaworthiness of a vessel, the manning of a vessel and the relevant working conditions and training, as well as the use of signals, collision prevention and maintenance of communications (Article 94, UNCLOS). Additionally, these measures include the safe navigation of ships, master's and officers' qualifications in seamanship, navigation, communications and marine engineering, crew number and qualifications, as well as the fact that seafarers are familiar with international laws regarding safety at sea, prevention of collisions and avoidance of pollution, and maintenance of radio communications (Article 94, UNCLOS).

Some flag States have adopted a passive stance towards exercising their jurisdiction and control over ships registered under their flag; hence the term Flag of Convenience (FoC) has emerged. International registries or open registries or FoC refer to a special maritime business practice in which a ship is registered in a country other than one of the ship's owners and the vessel carries that flag (Watterson et al., 2020). Hence, they permit ship owners to register their ships at low costs or to register vessels of low standards that would not adhere to the requirements of a more stringent State (Zwinge, 2011). Regardless of criticisms on safety and environmental issues, the popularity of open registries has risen because of their flexibility in operational and administrative aspects.

In the maritime literature, vessel flags have gained increased academic attention regarding their association with working or safety aspects e.g. Li et al. (2014). Considering reported data on injuries and casualties, efforts have taken place to identify if the implementation of safety procedures and their assessment vary among different national flags and between international flags and FoC (Alderton and Winchester, 2010; Ellis et al., 2010). For example, Li et al. (2014) found that different flags of registration have different impacts on a vessel's safety level and that closed registry vessels, when compared to open registry ships, are characterized by higher safety levels.

However, most studies in the literature have associated safety with several factors, not necessarily connected to vessel flags. For example, Jensen and Oldenburg (2021) observed the working conditions and stress levels onboard container vessels considering physical and psychological conditions, time pressure for decision making and the risk involved in the daily operations of a vessel. Chung et al. (2017) aimed at identifying the role of burnout in seafarers' health and well-being and its effect on safety. The mental health and well-being on board vessels and the practical steps that can be followed by employers to limit seafarers' exposure to risks associated with them were highlighted by Sampson and Ellis (2021).

However, to the best of our knowledge, no prior study has examined whether social sustainability differs among different categories of vessel flags. Few studies have examined seafarers' well-being during the pandemic and the flag effects on seafarers' depression and anxiety levels (Pauksztat et al., 2022b). Also, recent studies demonstrate that the poor welfare of seafarers is not connected to the vessel flag; it is, for example, the age of the ships that are considered an indicator of compliance with the MLC (2006) requirements (Exarchopoulos et al., 2018).

This study considers the international flags (or flags of convenience) that are included in the Paris MoU White List following the flag performance list (period 2019–2021). This list, the full spectrum of which involves the white, grey and black lists of vessel flags, presents a categorization from quality flags to flags with poor performance that are regarded as high or very high risk. This list is constructed on the basis of the total number of inspections and detentions, which concern a 3-year rolling period for flags with at least thirty inspections. Therefore, the focus on international flags that are considered "quality flags" and the exclusion of other flags characterized as medium, medium to high, or high risk, can provide comparable results for examining potential differences in maritime social sustainability between those and national flags.

In line with the above discussion, we hypothesize:

Hypothesis 2. There is no difference among the seafarers' perceptions of maritime social sustainability between national and international vessel flags.

3. Research methodology

3.1. Measurement instruments

The development of measurement items was based on relevant studies in the literature (Fotteler et al., 2018; Lima et al., 2015; Oldenburg et al., 2009; Pizam and Tasci, 2019; Sampson and Ellis, 2021). The *physical component* addresses the dimensions of the atmosphere affecting the five human senses such as lighting, noise, temperature, air quality and ventilation. In this regard, ten items are included in the questionnaire that aim to capture seafarers' perceptions on the temperature of cabins, accommodation areas and other ship's spaces, air quality and ventilation of cabins and accommodation areas, noise levels, as well as the lighting in cabins, accommodation areas and other ship's spaces. The *functional component* concerns certain factors, such as the design, layout, and space. The functional component is assessed using five items: the decoration and appearance of crew cabins, accommodation, crew recreational areas, hygiene facilities, and restroom facilities. Furthermore, *communication* is operationalized using four items and perceptions of seafarers regarding the ability to access the Internet. Six items capture the *healthy component* and assess seafarers' perceptions of food and beverages, as well as vibration and quality of sleeping onboard, i.e., attitudes towards taste and freshness of the food, variety of food types and beverages and quality of drinking water. The *cultural component* aims to capture the perceptions of the individual seafarers towards interacting with people of diverse cultures and religious beliefs and their level of confidence with verbal

Table 3
Sample Demographics.

		First sample (n = 604)	Second sample (n = 477)
		Percent	Percent
Currently working on a ship	Yes	58.3	54.3
	No	41.7	45.7
Working on a ship within the last 2 years	Yes	95.7	96.9
	No	4.3	3.1
Nationality	Filipinos	22.2	26.4
	Indian	18.0	14.9
	Russian	24.0	23.3
	Ukrainian	25.3	25.6
	Other	10.5	9.8
Gender	Male	98.8	99.4
	Female	1.2	0.6
Year of birth	Before 1960	2.6	4.8
	1960–1970	19.2	17.4
	1971–1980	26.8	28.1
	1981–1990	28.5	27.0
	1991–2000	22.7	22.5
	After 2001	0.2	0.2
Department on the ship	Deck	52.0	56.2
	Engine	42.7	39.4
	Steward	3.3	2.3
	Other	2	2.1
Rank on the ship	Rating	19.7	24.9
	Master	13.6	13.8
	Chief Officer/ Chief Mate	12.1	11.5
	Chief Engineer	12.9	10.3
	Second Engineer	8.1	8.8
	Junior Officer	12.9	10.3
	Cadet	5.6	6.1
	Other	15.1	14.3
Flag of current vessel of employment (or last ship's flag)	Cyprus	6.1	8.4
	Liberia	20.7	19.1
	Marshall Islands	10.9	10.7
	Bahamas	9.8	9.2
	Panama	6.1	3.6
	Singapore	4.1	4.4
	Dutch	7.1	5.5
	Antigua or Antigua and Barbuda	15.9	15.7
	Portugal	4.0	3.6
	Greece	2.2	2.9
	Malta	3.6	5.0
	Other or missing	9.5	11.9
Vessel flag	National	21.7	23.1
	International	77.2	75.9
	Missing	1.1	1
Type of ship of current employment (or last employment if not currently employed onboard)	Containership	25.5	26.4
	RO-RO	2.5	3.1
	Dry cargo/ Bulk carrier	36.4	38.6
	Oil tanker	8.9	7.3
	Chemical and product tanker	7.8	6.3
	Gas tanker (LNG)	3.8	2.5
	Heavy lift and/ or General cargo	4.5	6.7
	Other	10.6	9.1
Years of experience as a seafarer	1–3	13.9	14.8
	4–6	10.8	9.6
	7–12	24.0	22.0
	13–16	10.6	11.9
	17–20	11.4	13.2
	>20	29.3	28.5
Size of company compared to major competitors	Small	23.7	17.6
	Medium	47.8	48.0
	Large	23.7	29.8
	Very large	4.8	4.6

Table 4
CFA results for first sample, second sample and total sample.

	CFA results – First sample Standardized Regression Weights	CFA results – Second sample Standardized Regression Weights	CFA results – Total sample Standardized Regression Weights
Physical component			
The temperature in my cabin is pleasant.	0.633	0.642	0.638
In this ship, the temperature in the accommodation areas is pleasant.	0.699	0.716	0.707
In this ship, the quality of the air is good.	0.694	0.707	0.699
In this ship, the ventilation of cabins is adequate.	0.899	0.906	0.902
In this ship, the ventilation of accommodation areas is adequate.	0.880	0.916	0.896
In this ship, the noise levels from handling tools in the courses of routine shipboard maintenance are normal.	0.544	0.469	0.510
In this ship, crew cabins and accommodation areas are adequately lit.	0.534	0.587	0.553
Items excluded from the physical component: "In this ship, the noise levels caused by engines and other machinery are normal." "The temperature in other ship's spaces is pleasant." "In this ship, the lighting in other spaces (i.e., other than cabins and accommodation areas) is good."			
Functional component			
In this ship, crew cabins and accommodation areas are clean and well-maintained.	0.798	0.783	0.788
In this ship, crew cabins and accommodation areas are well decorated.	0.713	0.713	0.714
In this ship, the crew recreational areas and provisions, such as television and radio facilities, films, sports equipment, library, DVDs, music instruments, and/or gym facilities are nice.	0.670	0.689	0.681
In this ship, the hygiene and restroom facilities are satisfactory.	0.804	0.781	0.793
In this ship, cabin, and accommodation rooms' dimensions (i.e., height, area in square feet) make me feel comfortable.	0.727	0.751	0.739
Healthy component			
The taste and freshness of the food in this ship is satisfactory.	0.777	0.803	0.789
The variety of food types provided onboard is satisfactory.	0.897	0.883	0.890
The variety of beverages provided onboard is satisfactory.	0.753	0.773	0.761
Drinking water provided in this ship is plentiful and of good quality.	0.544	0.583	0.560
Items excluded from the healthy component: "In this ship, vibrations caused by engines are disturbing." "In this ship, the quality of sleeping is largely influenced by the continual rolling and pitching of the ship."			
Communication			
When working on this ship, I can have unrestricted access to the Internet often.	0.770	0.808	0.784
When working on this ship, I can make use of Skype often.	0.840	0.780	0.816
When working on this ship, I have access to satellite TV connection often.	0.567	0.509	0.543
Item excluded from communication: "When working on this ship, I am able to send emails often."			
Cultural component			
I feel confident working with people of different religious beliefs onboard.	0.884	0.880	0.882
I feel confident working with people of different cultures onboard.	0.945	0.945	0.945
I feel confident dealing with nonverbal behaviour (e.g., gestures) when I interact with other seafarers of different cultures onboard.	0.670	0.655	0.661
I feel confident dealing with verbal behaviour (e.g., words, tones, and style) when I interact with other seafarers of different cultures onboard.	0.732	0.691	0.713
Other seafarers avoid using expressions or words that can be considered offensive to people of different cultures or religions.	0.452	0.460	0.456
Goodness of fit			
	CMIN/DF = 2.952	CMIN/DF = 2.668	CMIN/DF = 4.327
	p = 0.000	p = 0.000	p = 0.000
	GFI = 0.910	GFI = 0.896	GFI = 0.922
	NFI = 0.913	NFI = 0.903	NFI = 0.928
	TLI = 0.931	TLI = 0.927	TLI = 0.934
	CFI = 0.940	CFI = 0.937	CFI = 0.943
	PCFI = 0.814	PCFI = 0.811	PCFI = 0.817
	FMIN = 1.170	FMIN = 1.340	FMIN = 0.958
	RMSEA = 0.057	RMSEA = 0.059	RMSEA = 0.056
	AIC = 827.537	AIC = 759.684	AIC = 1156.140
	ECVI = 1.372	ECVI = 1.596	ECVI = 1.070

and nonverbal behaviour of individuals of diverse cultures. For this reason, five items are used found in [Lima et al. \(2015\)](#).

3.2. Survey design, sample, and survey administration

The target audience of the current study is seafarers who are currently employed onboard merchant vessels or passenger ships and seafarers employed on a ship during the past few years.

The questionnaire presents the main aims of the survey and an important note regarding the confidentiality and anonymity of the respondents. Also, it includes questions on the demographic profile of the respondents, asking them to indicate -inter alia- their nationality, gender, department and rank on the ship, flag of the vessel etc. Regarding seafarers' perceptions of their well-being onboard

the ship, respondents are asked to denote the extent to which they agree with certain statements on a 7-point Likert-type scale ranging from “Strongly disagree” (1) to “Strongly agree” (7). Specifically, items on temperature, air quality, ventilation, noise levels, vibrations, lighting, food and beverage variety, quality of sleeping, as well as ease of communication, cleanliness, decoration, and cultural interactions among seafarers (as described above) are included.

The questionnaire was developed through the legitimate use of the SurveyMonkey online survey development tool and was electronically distributed to seafarers.

The preferred means of discriminant analysis is to split the sample into two sub-samples (Hair, 2010): one sample (analysis sample) is used for estimation and the other for cross-validation of the solution (holdout sample). Both sub-samples should have adequate size; most studies prefer a 60–40 split of the total sample for the analysis sample (60 %) and the holdout sample (40 %). Therefore, two separate samples of seafarers are used to evaluate and cross-validate the hypothesized construct of maritime social sustainability. The first sample consists of 604 seafarers and the second sample comprises 477 respondents.

The demographics of the first and second samples are displayed below (Table 3). In both samples, most seafarers were working on a ship (at the time of the survey) or had been working onboard within the last 2 years. The dominant nationalities of the samples are Ukrainian, Russian and Filipino. Almost all respondents are male and most of them were born between 1971 and 2000. Also, in both samples, most respondents work in the deck and engine departments, while they mainly hold the ranks of rating, master, chief officer, and chief engineer. As far as the type of ship of current employment (or last employment if not currently employed onboard) (at the time of the survey) is concerned, most seafarers work onboard a dry bulk vessel or a containership. In both samples, the largest percentage of respondents have over 20 years of experience in the seafaring profession. Finally, the dominant flags of vessels of employment are those of Antigua (or Antigua and Barbuda), Liberia, Marshall Islands, Bahamas, and Cyprus. The distribution of vessel flags in the samples is as follows: regarding the first sample, 77,2 % of the flags are international and 21,7 % of the flags are national, while the corresponding percentages for the second sample are 75,9 % and 23,1 %.

3.3. Analysis methods

The data are analysed by conducting Confirmatory Factor Analysis (CFA) to confirm the structure of the hypothesized construct and assess the overall model fit, as well as an independent-samples *t*-test, which is an inferential statistical test and is utilized to compare the means of two independent groups to ascertain if there is statistical evidence that the corresponding population means present significant differences.

4. Results and discussion

4.1. Maritime social sustainability construct

Firstly, CFA is conducted in the first sample. The results and the goodness of fit statistics for the first sample are presented in Table 4 (In the respective column for the first sample). Certain items are eliminated due to low standardized regression weights in response to CFA output. The model’s goodness-of-fit is assessed in line with the respective indices. Standardized residual covariances are also lower than the value of 2.5. The results in Table 4 indicate a good fit for the data. Table A1 (In the Appendix) shows that Cronbach’s Alpha value exceeds 0.7 signifying high levels of reliability.

The standardized regression weights of items are higher than 0.5 (or very close to 0.5) and statistically significant, while the average variance extracted is greater than 0.5, attesting thus the convergent validity of the model. According to Table A2 (In the Appendix), the average variance extracted estimates for any two factors is greater than the squared correlation estimates between these factors, indicating the presence of discriminant validity. Also, there is theoretical evidence that employee well-being is related to satisfaction (Findler et al., 2007). To capture seafarers’ overall satisfaction, two items are used, i.e., “Overall, I am satisfied with the working conditions onboard.” and “Overall, I am satisfied with the company I am working for”. Responses were made on a 7-point Likert-type scale from “strongly disagree” to “strongly agree”. Table A3 (In the Appendix) shows the correlation coefficients between the components of maritime social sustainability and the overall satisfaction measure. All coefficients are positive and significant. Thus, nomological validity is demonstrated.

To cross-validate the results obtained from the first sample, data are also used from the second sample of seafarers. The Cronbach’s Alpha coefficients for the constructs (Table A1 in Appendix) are satisfactory, showing thus adequate levels of reliability. The structure of the maritime social sustainability construct is further validated, and the good measurement properties are also confirmed (Table 4, in the respective column for the second sample). The standardized regression weights of the measurement items on the factors are statistically significant and greater than 0.5, verifying the convergent validity of the measurement models. The analysis produced a good fit with standardized residual covariances lower than 2.5 (Hair, 2010). Convergent validity is also evident, as the Average Variance Explained (AVE) values are greater than 0.5 (Table A4 in Appendix). Discriminant validity is ensured since the AVE values for any two factors are also higher than the squared correlation estimates between these factors, discriminant validity is ensured. Nomological validity is also demonstrated since correlation coefficients are positive and significant in Table A5 (Appendix).

Finally, the two samples are combined to form a single, total sample. The structure of the maritime social sustainability construct is also validated in the total sample (Table 4 and Fig. 1), the goodness of fit statistics is very satisfactory and thus reflect a particularly good fit. The standardized residual covariances are also within the limit of 2.5. Reliability (Table A1 in the Appendix), convergent, discriminant and nomological validities (Table A6 and Table A7 in Appendix) are also ensured. According to the results, *confirming our first hypothesis*, the maritime social sustainability construct includes five components, namely the physical component, the functional

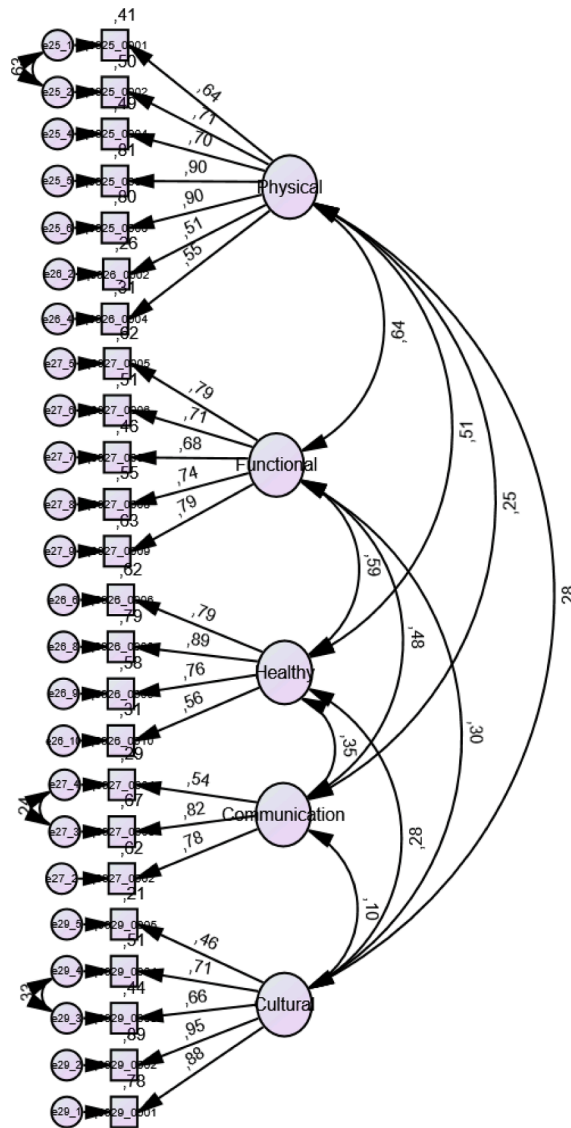


Fig. 1. CFA Results for the total sample.

component, the healthy component, communication, and the cultural component.

As elaborated in the theoretical section, the physical component encompasses conditions of the physical environment, in which seafarers work and live. These conditions refer to temperature, air quality, ventilation, noise and lighting, which are linked with the satisfaction of employees (Kim and de Dear, 2012) and thus revealed as important factors of the vessel. This result is consistent with past studies that uncovered that the amount of noise and lighting in the workplace is associated with workers' mood state (Kuller et al., 2006; Turan et al., 2011). The functional component emphasizes mainly the aspects of decoration and hygiene onboard. In line with this evidence in the literature, which associates the pleasantness of the working environment and cleanliness with positive employee-related outcomes (Horrevorts et al., 2018; Parish et al., 2008), the functional component of the vessel is part of maritime social sustainability, as it stresses the contribution of the quality of vessel facilities to positive seafarers' feelings (Sampson and Ellis, 2021).

The healthy component has been found to incorporate items that address the quality and quantity of food and beverages onboard. The incorporation of the healthy component into overall maritime social sustainability is in line with relevant studies in the literature that have uncovered that low quality of food provided onboard should not be neglected, since it is viewed as an important area of concern for seafarers (Fotteler et al., 2018). Communication is the fourth factor of the maritime social sustainability construct. The inclusion of communication, which helps towards maintaining social relationships with families and friends has already been highlighted in maritime literature (Papachristou et al., 2015). The ease of using communication facilities and being in touch with people ashore reduces negative feelings and makes life happier for seafarers (Oldenburg and Jensen, 2019; Pauksztat et al., 2022a; Sampson and Ellis, 2021).

Table 5
Measurement invariance across groups of seafarers.

Model	Comparison	Chi squared	df	CFI	RMSEA*	Δ CFI	$\Delta\chi^2$	Δ df	Statistical significance
M1. Baseline (unconstrained model)		1350.354	478	0.937	0.041				
M2. Measurement weights (factor loadings constrained equal)	M2 versus M1	1372.109	497	0.937	0.041	<0.01	21.755	19	ns
M3. Intercepts (intercepts constrained equal)	M3 versus M2	1391.918	512	0.937	0.040	<0.01	19.810	15	ns

Note: $\Delta\chi^2$ denotes the difference in χ^2 values between models; Δ df refers to the difference in number of degrees of freedom between models; ns stands for non-significant.

*RMSEA: Root Mean Square Error of Approximation.

Table 6
Differences in mean scores.

	t-test for Equality of Means	
	t	Sig. (2-tailed)
Physical component	-1.483	0.138
Functional component	-0.048	0.962
Healthy component	0.675	0.507
Communication	0.725	0.469
Cultural component	-1.171	0.242

Finally, the CFA output confirms evidence from the literature that cultural variations in the workplace are linked with employees' mental health (Pasca and Wagner, 2011), making the cultural component an integral element of maritime social sustainability. Differences among seafarers regarding verbal and nonverbal behaviour are evident in a multicultural environment a vessel, which in turn can thus be related to seafarers' psychosocial stress (Jensen and Oldenburg, 2020).

4.2. Measurement invariance

Further analyses are performed to ascertain whether the factor structures for the maritime social sustainability construct are invariant across groups of seafarers (Mehdizadeh et al., 2019). The total sample of seafarers is split into two groups; the first group includes respondents being employed onboard vessels flying a national flag and the second group includes seafarers being employed onboard a vessel registered with an international flag. Measurement equivalence is used to examine whether an instrument is measuring the same construct for distinct groups of people, in our case distinct groups of seafarers. In a baseline (unconstrained) model (M1), parameters are simultaneously estimated for all seafarers, implying that no parameters are constrained to be equal, and configural invariance addresses whether the structure of the maritime social sustainability construct is invariant across groups. Then, metric invariance is examined to test the consistency of factor loadings across the two models and ascertain whether similar response patterns are evident across the groups. So, a second model (M2) constrains all parameters of the indicator variables to be equal. If the $\Delta\chi^2$ (from the baseline model) is non-significant and the change in the CFI is no greater than 0,01, metric invariance is supported. Then, structural invariance is examined in the third model (M3) for determining that item interpretation is the same across the groups of seafarers. Specifically, "Structural invariance needs the intercepts for each item on its factor to be constrained across models" (Mehdizadeh et al., 2019).

Results in Table 5 confirm that the factor structures from the operationalization of the maritime social sustainability construct are the same and have a similar meaning in both groups. Specifically, since configural invariance is established, we can conclude that the same factor structure of maritime social sustainability is evident in the two groups. Metric invariance shows that the factor loadings are the same in both groups. Strong measurement invariance is also met. Therefore, the factor structure for maritime social sustainability is equivalent across the two groups of seafarers.

4.3. Differences between vessel flags

The independent-sample t-test is utilized to examine statistically significant differences in the means of maritime social sustainability factors between groups of seafarers being employed onboard vessels flying national and international flags. As a response to the second hypothesis, the results presented in Table 6 provide evidence for the absence of statistically significant differences between the two groups of seafarers on the mean scores of the factors. According to the study findings, seafarers perceive the same level of maritime social sustainability irrespective of the flag of the vessel of their employment. In other words, seafarers' evaluation of conditions on board related to all aspects of social sustainability (as conceptualized in this study) seems to be irrelevant to their ship's flag State.

Under the current international framework that regulates the shipping industry and sets minimum standards for the provision of a safe working environment, fair employment terms for crew members, decent working and living conditions on the ship, protection of health, provision of medical care and social protection (MLC, 2006), flags States must thoroughly examine and certify ships under their

registry. Although flag States are quite cautious about whom they accept on their registries, some of them are still tolerant of poor conditions onboard ships (Exarchopoulos et al., 2018) and perhaps the lower level of perceived well-being onboard. However, the study's findings argue for the indifferent role of vessel flags on seafarers' self-evaluations of their social sustainability, which is in line with the evidence in the literature that MLC (2006), deficiencies and the detentions are not linked to the registry of the vessels (Exarchopoulos et al., 2018). As such, it seems that the negative connotation of the term's international flags or "flags of convenience" may be unjustified when it comes to maritime social sustainability.

Considering that most vessels of the world merchant fleet fly an international flag, associating these registries with substandard conditions may be meaningless and misleading. Vessels with substandard conditions or vessels operating at the highest standards can be found both under national and international flags, reinforcing the fact that seafarers' welfare does not seem to be connected to the ships' flag and calling for further consideration of other variables, such as ships' age (Exarchopoulos et al., 2018).

5. Conclusions

The maritime transportation sector has a key role in promoting sustainability efforts at a global level. Literature on shipping sustainability issues is increasing; however, research on social sustainability in the maritime industry is still quite limited. The current study aimed to contribute to the shipping sustainability agenda by conceptualizing and measuring maritime social sustainability. This aim is in line with one of the core responsibilities of the maritime industry – also linked to the eighth sustainable development goal, i.e., providing a safe and healthy working environment (Wang et al., 2020).

The seafaring profession has unique characteristics that differentiate it from other professions. Despite the existence of regulatory frameworks that attempt to address working and living conditions onboard, stress and fatigue among seafarers are still evident. Thus, the shipping industry has realized the importance of improving the workplace environment and thus enhancing social sustainability performance.

Maritime social sustainability is conceptualized and empirically supported as a multidimensional construct consisting of five discrete components: the "physical" component, the "functional" component, the "healthy" component, the "cultural" component and "communication". Our results reinforce previous literature on the importance of those critical components. By splitting the data into two groups – those seafarers onboard national flag vessels versus those onboard vessels flying international flags – it was discovered that both groups similarly identify the factor structure of maritime social sustainability. Also, it is established that there are no statistically significant mean differences in the assessment of those components between groups of respondents being employed on board a vessel flying a national and an international flag. Thus, perceptions are not associated with the flag of the vessel and the findings challenge the common belief of major differences and support the notion that seafarers who work onboard a vessel that flies the flag of a traditional maritime nation (i.e., a national flag) and those that are employed onboard a vessel flying an international flag seem to hold similar evaluations of the major dimensions that form their social sustainability.

5.1. Managerial and policy implications

Shipping companies and industry stakeholders (including IMO, ILO, WHO, UNCTAD, ICS, and ITF) (UNCTAD Review of Maritime Transport, 2021) have long ago recognized the importance of seafarers' well-being as essential for ensuring safe and reliable maritime services and published and adopt practical policies and guidelines which aim to strengthen seafarers' mental health and well-being (such as UK Chamber of Shipping, Nautilus International and the National Union of Rail, Maritime and Transport Workers, RMT). This is even more evidenced in the world maritime theme for 2021, i.e., "Seafarers: at the core of shipping's future", which has drawn the industry's attention to the invaluable role seafarers play now and, in the future, especially since COVID-19 pandemic has placed many challenges on them³ that may cause even mental health emergencies (Pauksztat et al., 2022a).

For example, the International Chamber of Shipping recently launched a new document to assist shipping companies to handle mental health emergencies and detecting suicidal behaviour⁴, while the International Seafarers' Welfare and Assistance Network (ISWAN) has published guidelines for inter alia mental health or psychological well-being at sea to encourage the welfare of seafarers all over the world⁵.

Moreover, it is commonly believed in the industry practice that flying a -as at least considered- not reputable FoC may -by itself- cause serious problems to the seafarers' well-being due to poor vessel conditions, unsuitable food or clean drinking water and long employment periods without adequate rest that lead to stress and fatigue for crew members.

Because of the unique characteristics of the seafaring occupation and as maritime social sustainability is not a theoretically well-established concept, this study aims first to cover this gap by proposing a new and holistic "soft" assessment tool of maritime social sustainability to help shipping companies and other interested groups of stakeholders (e.g. crew management companies, charterers' associations etc.) to use it as a "barometer" to evaluate the working and living conditions of the crew onboard vessels. This barometer focuses on soft issues and uses measurement dimensions, namely "Physical component", "Functional component", "Healthy component", "Communication", and "Cultural component" and allows to (i) assess and measure the current level of perceived social sustainability for enhancing the quality of work life for seafarers (ii) compare different units among different vessels, fleets, and

³ <https://www.imo.org/en/About/Events/Pages/World-Maritime-Theme-2021.aspx>.

⁴ <https://www.ics-shipping.org/publication/handling-a-mental-health-crisis-or-emergency-and-spotting-suicidal-behaviour-in-seafarers/>.

⁵ <https://www.seafarerswelfare.org/seafarer-health-information-programme>.

Table A1
Reliability analysis.

	Cronbach's Alpha		
	First sample	Second sample	Total sample
Physical component	0.870	0.876	0.872
Functional component	0.851	0.849	0.850
Healthy component	0.819	0.836	0.827
Communication	0.783	0.769	0.777
Cultural component	0.868	0.856	0.863

Table A2
First sample – Convergent and discriminant validity.

	Physical component	Functional component	Healthy component	Communication	Cultural component
Physical component	0.5047	0.3819	0.2809	0.0338	0.0876
Functional component	0.618	0.5538	0.2798	0.1918	0.0985
Healthy component	0.53	0.529	0.568	0.0942	0.0734
Communication	0.184	0.438	0.307	0.54	0.0023
Cultural component	0.296	0.314	0.271	0.048	0.5726

Note: AVEs are shown in the main diagonal, correlations are presented below main diagonal, squared correlations are the values above main diagonal.

Table A3
First sample – Nomological validity.

	Physical component	Functional component	Healthy component	Communication	Cultural component	Satisfaction
Satisfaction	0.528**	0.494**	0.436**	0.132**	0.308**	1

**Correlation is significant at the 0.01 level.

Table A4
Second sample – Convergent and discriminant validity.

	Physical component	Functional component	Healthy component	Communication	Cultural component
Physical component	0.5215	0.4422	0.247	0.1056	0.0691
Functional component	0.665	0.554	0.4303	0.2819	0.0841
Healthy component	0.497	0.656	0.59	0.1648	0.0784
Communication	0.325	0.531	0.406	0.507	0.0289
Cultural component	0.263	0.29	0.28	0.17	0.5572

Note: AVEs are shown in the main diagonal, correlations are presented below main diagonal, squared correlations are the values above main diagonal.

Table A5
Second sample – Nomological validity.

	Physical component	Functional component	Healthy component	Communication	Cultural component	Satisfaction
Satisfaction	0.553**	0.618**	0.566**	0.319**	0.371**	1

**Correlation is significant at the 0.01 level.

Table A6
Total sample – Convergent and discriminant validity.

Total sample	Physical component	Functional component	Healthy component	Communication	Cultural component
Physical component	0.51071	0.4057	0.2652	0.0615	0.0789
Functional component	0.637	0.554	0.3422	0.2304	0.0924
Healthy component	0.515	0.585	0.5772	0.1239	0.07617
Communication	0.248	0.48	0.352	0.5253	0.0094
Cultural component	0.281	0.304	0.276	0.097	0.5652

Note: AVEs (Average Variance Explained) are shown in the main diagonal, correlations are presented below main diagonal, squared correlations are the values above main diagonal.

Table A7

Total sample – Nomological validity.

	Physical component	Functional component	Healthy component	Communication	Cultural component	Satisfaction
Satisfaction	0.539**	0.550**	0.496**	0.219**	0.337**	1

**Correlation is significant at the 0.01 level.

companies longitudinally, (iii) apply focused remedies and identify and evaluate any areas of improvement, (iv) apply a soft assessment framework for examining the implications of maritime social sustainability over time and take proactive measures to improve it by suggesting cost-effective alternatives.

This study after examining different sets of seafarers concludes that the choice of a ship registry is not by itself associated with seafarers' perceptions of better or worse working and living conditions onboard a vessel flying a national or an international flag. This finding challenges the common belief, and confirms that procedures and guidelines of [MLC \(2006\)](#) and Standards of Training, Certification and Watchkeeping for Seafarers (STCW) are properly and equally applicable at least to major international flags (e.g., Marshall Islands, Cyprus, Malta, Liberia etc.) and aligning those with other flags (e.g., Togo), which are in Blacklists, may be wrong ([Exarchopoulos et al., 2018](#)). It finally calls on focusing on other factors that potentially would affect maritime social sustainability, such as type of vessel, rank, or department onboard, and owners' nationality shifting thus the focus away from ship registries alone.

The maritime social sustainability construct reflects the special characteristics of the seafaring occupation and the elements of seafarers' working environment, i.e. the vessel. This conceptualization tries to account for the physical conditions of the vessel that impact the human senses and considers environmental conditions, such as temperature, air quality, noise etc. Considering the confined nature of a vessel workspace, these environmental conditions emerge as rather important when examining seafarers' social sustainability. In fact, the environmental conditions of shore-based workspaces have been found to influence employees. This is more profound for seafarers who are not able to leave their working environment, for example after an 8-hour shift as employees in shore-based business environments usually do. Besides these environmental conditions, which are mainly addressed in the physical component, the functional elements of the vessel are also considered in the proposed construct. This functional component aims to reflect the quality of the seafarers' cabins and accommodation areas in terms of aesthetics and maintenance. Seafarers spend several hours in accommodation or cabin areas, so overlooking these conditions would undermine the effort to provide a comprehensive measure of maritime social sustainability. As discussed in the theoretical section, research on how the aesthetics of a consuming environment affects customers was the starting point to examine how functionality, colours or design may also play an important role for employees in their working environments. In line with this literature, the proposed conceptualization sheds light on these aspects, considering that improvements in terms of decoration or cleanliness could enhance seafarers' well-being during rest hours.

Besides vessel conditions per se, health and nutrition have been topics of discussion in relevant studies and areas of concern in maritime stakeholders' initiatives. This is also reflected in the proposed construct considering that food is important to support seafarers' lives onboard and to fulfil their nutritious demands, not only in terms of quantity but of quality as well. The enforcement of relevant regulations (i.e., [MLC, 2006](#)) aimed to ensure high levels of hygiene and quality food and water onboard; yet food issues need constant attention. Furthermore, the social aspects of maritime social sustainability concern on the one hand, the communication between seafarers and their families and on the other hand, the ability of seafarers to adapt to a multicultural environment, as the latter ability pertains to the quality of relationships with their peers. Once again, relevant Conventions address the aspect of communication through access to Internet facilities; despite the presence of a relevant guideline in [MLC \(2006\)](#), the issue calls for the need of further regulatory actions. Lastly, the significance of cultural adaptation and respect of cultural differences has been at the forefront in the maritime industry. For example, the TMSA tool refers to several related aspects, such as promotion of cultural awareness, provision of training of cultural awareness, consideration of cross-cultural values, promotion of cross-cultural interpersonal skills or enhancement of cross-cultural understanding for shore-based and vessel personnel. The inclusion of the cultural component in maritime social sustainability is in accordance to maritime industry standards and indicates that being able and confident to work in a multicultural workspace is fundamental for seafarers' well-being.

Regulators have taken important steps to account for seafarers' social sustainability as reflected in international Conventions, standards and codes. In addition, initiatives by the IMO and UN target the improvement of social sustainability at sea. Maritime stakeholders' efforts also point to the direction of enhancing human sustainability at sea. For instance, the most recent introduction of Seafarers Human Sustainability Declaration invests in the sustainability of seafarers through their recognition as the most critical resource for the maritime industry and draws on relevant maritime regulatory frameworks. The five Articles in Seafarers Human Sustainability Declaration are expressed in general terms but aim to tackle many well-being, safety and security aspects of seafarers and their families. The conceptualization of maritime social sustainability as presented in the current study is in line with the Declaration, especially when it comes to ensuring well-being at sea, nutrition, as well as communication with those at home. All, in all, the proposed maritime social sustainability framework considers the efforts to remedy seafarers' concerns on their working environment and may assist towards prioritizing future regulatory actions. As it is multidimensional in nature and covers several facets, it could be the trigger for further measures in the maritime industry, such as free and unlimited communication opportunities onboard, the existence of a wide range of recreational activities to account for seafarers' diversified desires, the presence of comfortable provisions in cabins and accommodation areas to ensure quality rest for seafarers or minimum budget allocation for food variety and quality ([Sampson and Ellis, 2020](#)). These measures could be performed uniformly irrespective of vessel type of flag.

5.2. Limitations and suggestions for future research

This study considered two broad categories of vessel flags, i.e., national, and international flags. Future studies could test for mean differences among individual flags or among flags that present the most and least MLC (2006) detentions. Also, as the current study identified that maritime social sustainability is not associated with the flag the vessel flies, future research could focus on the shipping company that operates the vessel. For example, future studies could investigate what kind of steps a shipping company is implementing to contribute to helping seafarers in their lives onboard vessels effectively. This study considered the representation of international flags in the Paris MoU White List. Future studies could focus on detention and deficiencies reports provided by Tokyo MOU or the United States Coast Guard (USCG). Further investigations could be performed to ascertain the association between perceptions onboard and other variables, such as seafarers' nationalities, rank on the ship, department onboard etc. Future studies could also account for potential differences in maritime social sustainability perceptions among operators in other parts of the world, such as Netherlands, Norway, USA and Canada etc., or among clusters of countries in order to ascertain whether the location of the owners of the company that seafarers work for impact their perceptions.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A

See Tables A1–A7.

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