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Embracing Sustainability in Shipping: Assessing Industry's Adaptations Incited by the, Newly, Introduced 'triple bottom line' Approach to Sustainable Maritime Development

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Abstract: Increasing environmental, social and economic problems, born by unceasing economic growth, have transformed our approach to the development concept. The 1980s saw the appearance of the sustainable development term and, during the 1990s, sustainability notion was implicitly framed as an integrated concept, frequently, termed as the 'triple bottom line' approach. Among several initiatives and efforts to balance our economic and societal pursuits with environmental challenges the, lately, introduced United Nations (UN) Sustainable Development Goals (SDGs) refer to a remarkable evolution, which came to strengthen and establish sustainability conception as an integrated social, economic and environmental triptych. International shipping, as the major carrier of world trade and significant contributor to environmental degradation has, definitely, a vital role to play in facilitating the UN's sustainability venture. Although there is a great amount of legislative instruments, codes and guidance to address sustainability in shipping, though, limited research has been devoted to identify how the tanker and dry bulk maritime sector has responded to such recent cohesive attitude to sustainable maritime development. Through a quantitative research approach this empirical study aimed to investigate maritime industry's insights and attitudes in relation to the, newly, introduced triple bottom line approach to global sustainable development. Research data were collected via a questionnaire survey conducted to 50 tanker and/or dry bulk shipping companies. Pearson's chi-square test of independence and Spearman's correlation coefficient measures were utilized to test our three formulated hypotheses. Findings highlighted increasing awareness and adaptation of the maritime sector to the triple bottom line approach and, subsequent, sustainability absorption under the auspices of a corporate social responsibility (CSR) business model. Introduction of sustainable development in an integrated manner appears to have influenced the extent that statutory maritime regulations occupy to the formulation of marine safety management systems. To sum up, the integrated management system model turned out to be the most rated tactic to manage sustainability and, as such, a conceptual CSR framework was proposed to facilitate such an objective.

Keywords: triple bottom line approach; world development; sustainable shipping; corporate social responsibility; marine management systems

1. Introduction

Development is a broad concept that has been, sporadically, manipulated by several social, political, economic and academic disciplines and actors. Its multi-dimensional nature has allowed, all the way through the earliest times of our civilization the creation of a variety of approximations and studies with the aim to realize and define the real meaning of development in our world ([Edwards](#)

1993). In an attempt to contextualize and conceptualize its meaning, a review of the several definitions of the development notion shows that it has been, primarily, considered as a process, which aims to establish a better life for humans and society (Gran 1983). Further to that, Todaro and Smith (2012) regard development as a physical and mental state where society has been provided with all essential resources to achieve a better quality of life. Historically, the end of World War II signified a new era, where development was treated, synonymously, to economic growth (Turner 1997). Thereby, in the 1950s and the 1960s, such economic dimension of development was further strengthened and accompanied with the desire to increase industrialization and productivity. In that sense, development was, mainly, identified with bigger production rates to the satisfaction of society needs (Bryant and White 1982). However, in the mid-1960s onwards an amalgam of societal and environmental problems appeared in the global scene, which significantly transformed our thinking on the development meaning. Accordingly, the sustainable development concept was introduced and encompassed the world's objectives to reverse environmental impacts caused by unceasing economic development. Since then, concern has been, obviously, shifted on preserving our planet's natural resources, while securing society's welfare, rather than focusing on mere economic growth (United Nations 2013).

The introduction and implementation of United Nations 2030 Agenda and Sustainable Development Goals, in 2015, bears clear implications for the private sector, which is called to collaborate with governments and demonstrate commitment in preserving our ecosystem (Pedersen 2018). It is evident that the shipping industry has a significant role to play to such global sustainability mandates. The strategic economic and social importance of maritime transport, along with its recognized efficiency and effectiveness as major transport mode (estimated in tonne-miles) has acknowledged shipping as a critical facilitator and contributor to global sustainable development requirements (Psarافتis 2019). Additionally, shipping is responsible for generating negative environmental and climate change impacts through CO₂, NO_x and SO_x emissions, oil pollution, transfer of ballast water sediments, ships recycling activities, etc. It is, therefore, imperative under UN's 2030 Agenda to adopt and implement a wide spectrum of measures to deal with such issues (Allal et al. 2018). As a response, the International Maritime Organization (IMO) has welcomed UN's initiative and committed itself in, continuously, improving the industry's image and contribution to sustainable development requirements. Moreover, the Organization has urged the maritime community to consider a wide range of subjects and challenges that may contribute to shipping sustainability (energy efficiency, technology, maritime education, safety culture, maritime security, cooperation and know-how exchange, etc.) and highlighted, for the first time, corporate social responsibility as a strategic tool to place shipping on a sustainable track (Sekimizu 2012). From a European perspective, the European Union (EU), through the establishment of the European Sustainable Shipping Forum (ESSF) and White Paper adoption, has demonstrated its harmonization and commitment to improve shipping industry's contribution to the latest sustainability trends (Ringbom 2018).

Further to the above challenges, this study seeks to contribute to the existing maritime sustainability framework by addressing the gaps and suggesting a conceptual process to facilitate implementation of sustainable development in the maritime industry, as an integrated notion. In the following sections, the study continues with a review of the theoretical framework for sustainable development and summarizes relevant sustainability research, regulatory developments and critical factors that urged the application of the triple bottom line approach in shipping. Thereafter, the rationale for the development of research hypotheses and selection of methodology is discussed. Next, results from a questionnaire survey and quantitative analysis are presented and analyzed, along with hypotheses testing outcome. Following, deductions and conclusions from this study are drawn and complemented by implications, limitations and opportunities for future research.

2. Literature Review

Further to our introduction, during the 1980s, the progressive and evolving process of the development concept shifted towards environmental affairs and the need to combine development

without harming the environment. The formation of United Nations World Commission on Environment and Development (WCED), in 1983, aimed at introducing and establishing a new approach to development that would, principally, raise awareness on the catastrophic consequences of socio-economic development on natural resources and the environment as a whole (Mebratu 1998). However, continuous degradation of world's natural resources and publicity of disastrous environmental effects, as a result of unbridled economic development, accelerated and increased public sensitivity for environmental affairs (Vitousek et al. 1997). In 1987, the United Nations World Commission on Environment and Development (WCED), known also as the Brundtland Commission, through the report *Our Common Future*, highlighted the need to balance social and economic pursuits with environmental preservation (WCED 1987). Though, a remarkable point of the Brundtland report was the introduction of the sustainable development concept, which meant to set new directions and shape our way of thinking on the global development process (Helming et al. 2008). As such, the emergence of sustainable development term was a reality and defined as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (WCED 1987, p. 43).

Since the Brundtland Commission, in 1987, an abundance of theoretical reviews and interpretations of the sustainable development concept have been taking place. According to Hotelling (1931) the scarcity of natural resources and the essence to use non-renewable natural resources with care and diligence has constituted the core of sustainability. In that respect, Holdgate (1993) emphasized the need to consider the limitations of the earth's natural resources and, as such, any productivity increases and technological advances should be taking into account such scarcity. However, there is a general consensus that sustainable development refers to a multidimensional issue that can be approached by several angles, which complicates somehow its uniform interpretation (Radermacher 1999). In that respect, it is obvious that the sustainable development term contains two fundamental concepts: Sustainable and development (Sharpley 2000). As such, from an economic perspective, development seeks to achieve capital maximization and growth. In sociology, development is more concerned with societal relationships and human rights. Ecology treats development from the angle of preservation of biological species and natural environments (Rios Osorio et al. 2005). In terms of the sustainability notion, the contribution of the Brundtland Commission report underlies that the idea of sustainable development refers to a complementary, mutual and unified concept, incorporating economic, social and environmental dimensions (Kuhlman and Farrington 2010). However, in the 1990s, John Elkington (1997) was the first who, deliberately, coined and launched the sustainability concept as a unified term, the so called triple bottom line approach, which integrated the existing scattered social, environmental and economic aspects and approximations. Since then, and despite the several distinctions and intellectual approaches, the triple bottom line approach has prevailed and is, gradually, used synonymously to sustainable development (Hammer and Pivo 2017). Moreover, despite the several academic and political debates on its exact definition, the integrated triptych of environmental, social and economic values has dominated the business world and, as such, every effort to measure and frame an organization's performance has been motivated by the essence to balance business economic targets with social and environmental impacts (Goel 2010).

The use of oceans, covering almost three quarters of our planet, constitute a vital source of income, nutrition and climate stability and their preservation is, therefore, imperative for the sustenance of our economic, ecological and societal systems. Protecting, therefore, our oceans and safeguarding the life of seafarers is by definition a matter of maintaining our planet's continuity and society's welfare (Spalding 2016). Such value of the oceans has been, primarily, identified and safeguarded by the United Nations Convention on the Law of the Sea (UNCLOS), which amongst others, aims to establish an international framework and governing rules that ensure the sustainable use of the oceans (Pyć 2016). Due to the crucial role that shipping has to play to the facilitation of world trade, its indisputable contribution to the global economy and its obvious impact to several stakeholders (i.e., seafarers, local communities, fisheries, environmental and non-governmental organizations, shippers, etc.), there is

an imperative necessity to maintain and promote the sustainable character of the maritime industry (O'Brien 2002). Although, shipping is considered as the most environmental friendly and efficient transport mode, however, the growing use of the oceans increases negative externalities (i.e., ship's emission and subsequent greenhouse effects, loss of life at sea, cargo and ship damage, etc.; Gilbert and Bows 2012).

Shipping is an, inherently, international industry that has been, justifiably, given the attribute of the most efficient transport mode. Indeed, efficiency and low cost of transporting large quantities of bulk or containerized cargo by sea have established maritime transport as the dominant carrier of world trade, with, approximately, 90% of goods to be carried by sea (Mitropoulos 2005). However, despite its efficiency, seaborne transport generates negative impacts. Actually, the shipping industry has direct impacts to the environment, through CO₂ emissions and accidental or operational marine pollution (i.e., oil spills, release of harmful ballast water sediments, sewage, cargo residues release, etc.; Chang and Danao 2017). Moreover, the shipping profession is a risky occupation and the 'safety at sea' term is an imperative for maritime industry viability. As such, there are numerous sources of risks that may threaten the safety of people on board and ship's structural integrity, with some of them being attributed to human error, poor weather conditions, equipment failure, etc. (Galić et al. 2014). Furthermore, security of merchant shipping refers to a recent and growing area of concern that threatens the industry. Seafarers and ships are easy targets and highly exposed to several security threats, such as piracy, smuggling, terrorist attacks, etc. (Bueger 2015). Therefore, reduction of CO₂ emissions, along with energy efficiency measures and protection of life at sea has been, thoroughly, placed at the forefront of strategies and initiatives of organizations and other maritime stakeholders (Chatzinikolaou and Ventikos 2011). In 1948, in an attempt to regulate and eliminate aforementioned perils and challenges at sea, the International Maritime Organization (IMO) was created. Through the IMO Convention 1948, the Organization, which is comprised by approximately 170 Member States, acts as the United Nations specialized Agency to ensure safety of life at sea and protection of the marine environment, and has been, actively, involved in the law-making process and generation of internationally applicable maritime statutory legislation (Karim 2016).

Coming to the sustainability issue, on September 2015, our world came up with a historic decision, which meant to change our approach to sustainable development and, additionally, bear a significant impact to the shipping industry. The 2030 Agenda on Sustainable Development, adopted at the United Nations Headquarters, in New York, set global goals and targets in order to achieve sustainable development in its three dimensions (economic, social and environmental; United Nations 2015). The 2030 Agenda, comprised by 17 goals, 169 targets and 230 indicators, refers to a comprehensive instrument that urges the international community to focus and act on critical to our planet challenges including, poverty eradication, resource use efficiency and waste reduction, human rights, creation of decent work genetic resource sharing, etc. (Hambrey 2017). Although such undertaking was not the first initiative assumed by the United Nations, however, a revolutionary idea and underlying key for the success of such movement refers to the profound integrated approach to sustainable development (Hong 2017).

In the outcome of such regulatory and policy evolutions, the concept of a sustainable maritime industry is a subject that has, over time, generated various interpretations and definitions, in terms of its theoretical and practical consideration and implementation. Comparing to land-based industries, the issue of sustainability in shipping has been, traditionally, treated as synonymous to the elimination of environmental impacts generated by maritime operations (Cabezas-Basurko et al. 2008). Traditionally, environmental sensitivity and elimination of environmental risks has been laid in the forefront of companies' strategy (Progoulaki and Roe 2011). Moreover, safety performance and eradication of risks related to navigation, occupational health and safety, ergonomics, ship operations and maintenance and crew welfare matters have always been a top priority for ship and shore personnel (Boisson 1999). Lun et al. (2014) notes that shipping companies consider environmental issues to be more critical for their business, comparing to social matters. At the operational level, commitment towards

sustainability was more seen as an attempt to ensure compliance with applicable environmental and safety regulations, rather than as a notion integrated into company's policy (Pawlik et al. 2012). Similarly, stakeholders interest in shipping has, habitually, concentrated to environmental and safety matters, which were, mainly, seen as an obligatory and legally binding endeavor (Tzannatos and Stournaras 2015). However, no matter the angle that someone approaches such a notion, the 2030 Agenda and Sustainable Development Goals (SDGs) attained to mainstream specific goals and objectives across the maritime sector and, thus, frame quantitative and measurable targets that the shipping industry has to achieve and demonstrate its contribution to global sustainability efforts (Parry et al. 2018). It would be worth mentioning though that, recently, the container and cruise shipping sector has raised the issue of sustainability in an integrated manner (Pawlik et al. 2012). As such, along with safety and environmental issues, economic transparency and social welfare have constituted a meaningful factor to liner shipping companies' strategy (Prusan-Jorgensen and Farrag 2010).

At the policy and regulatory level, the International Maritime Organization has, at present, recognized and mapped shipping industry's contribution to the 2030 Agenda and SDGs. The development of the Organizations' Strategic Plan, for the six-year period 2016 to 2021, aimed, specifically, at setting strategic directions (SD) and measurable targets (Sciberras and Silva 2018). Thus, specific goals have been set by the Organization in areas such as, safety culture promotion, technology innovation, energy efficiency, maritime security enhancement, education and training of seafarers, etc. However, it is worth underlining that, at the policy level, and for the first time in its history, IMO has conceptualized and acted towards the achievement of a sustainable maritime transportation system, which is founded on the integrated principles of the triple bottom line to sustainable development (Sekimizu 2012). In this line, and within the European Union framework, the European Maritime Safety Agency (EMSA) has further emphasized the need to strengthen sustainable maritime development on the three pillars of environmental, social and economic integration. On September 2013, the European Sustainable Shipping Forum (ESSF) was established with the aim to contribute to recent sustainability challenges. Furthermore, inclusion and understanding of maritime stakeholders' interests and processes was highlighted as a vital point in supporting such sustainable shipping initiatives (EMSA 2019). Additionally, several industry's Associations, such as the Norwegian Shipowners Association emphasized the need to foster a sustainable shipping industry on the principles of the triple bottom line approach, contributing, thus, to global sustainability targets (Norwegian Shipowners Association 2019). In this line, major classification societies have addressed the impact of SDGs in shipping, the opportunities they create and the imperative to consider sustainability in an integrated and not fragmented manner (Gjølberg et al. 2017).

Bearing in mind the recent introduction of UN 2030 Agenda and SDGs in shipping, and reviewing relevant studies, it is assumed that, with the exception of a few shipping segments (i.e., container and passenger industry), no significant empirical research has been undertaken to identify tanker and dry bulk sector perceptions and practices, in relation to the introduction of the triple bottom line approach to sustainable maritime development. Such stimulated global interest to address sustainability in shipping in an integrated manner (triple bottom line) and not through fragmented and retrospective policies or regulatory treaties have constituted a critical motivator for this study. It would be beneficial, though, to identify how the shipping industry has reacted and adapted to such trends with the objective to correct irregularities and propose effective management regimes. It is reasonable that effective implementation and achievement of Sustainable Development Goals requires, primarily, adequate understanding of the three sustainability pillars (environmental, social, economic). It would be, therefore, of great value to assess theoretical and practical comprehension and implementation of such a notion within the maritime context and identify any potential influences in the functions and processes of shipping companies. Hence, the aim of this study is to investigate and illuminate the shipping industry's (tanker and dry bulk sector) insights and adaptation to the application of the, recently, urged triple bottom line approach to sustainable maritime development.

3. Theoretical Foundations and Hypotheses

3.1. Triple Bottom Line Approach to Sustainability and CSR Correlations

The term of corporate social responsibility, as a theoretical concept and tactical issue, has, nowadays, been brought to the forefront of a company's business strategy and corporate objectives. Globalization trends, liberalization of trade and stakeholders' unrestricted access to information have transformed perceptions of business towards society and vice versa (Kiran and Sharma 2011). Since the 1960s and 1970s, corporate social responsibility has gained growing importance and recognition in business practices. Despite the abundant literature and academic approaches and research on that term, it has been, mainly, rooted in the social contract theory and depicts society's expectations from corporations and business actors (Carroll 1999). According to Davies (1973) such expectations extend beyond the mere compliance and fulfillment of a firm's regulatory duties and financial obligations and, thus, incorporate several other aspects that interrelate with business activities (i.e., social, ethical, moral environmental, etc.). There are several global corporate social responsibility (CSR) Standards (i.e., Global Reporting Initiative, ISO26001, SA8000, etc.) that provide guidance and aim to set universally adopted principles on CSR. Though, they all maintain a voluntary and consultative character (Ganescu 2012).

Developments in international legislation, along with increasing stakeholders' pressure, have urged companies to focus and manage multilateral and complex environmental, social and economic issues (Doz and Kosonen 2010). Although engagement with such subjects is not new, however, United Nations 2030 Agenda and SDGs have set the legal framework for private business to engage and demonstrate compliance and achievements towards measurable sustainability objectives (Yakovleva et al. 2017). Under such regulatory and business evolution, CSR can constitute a strategic management tool that could assist companies to integrate and achieve their sustainability performance. Given the fact that a fundamental role and obligation of business is to eliminate negative impacts and operate responsibly, it goes without saying that sustainability objectives should form part of corporate strategy (Baumgartner 2014). As stressed previously, shipping is a large, international and diversified industry and, as such, utilization of seaborne trade has a significant impact on society, economy and the environment. Increasing statutory maritime legislation aims at regulating the hazardous and detrimental aspects of shipping activities, reducing, thus, its negative health, safety, social and environmental impacts (Lai et al. 2011). What can be deduced at this point is that sustainable development, as currently attempted under the triple bottom line approach, intersects and is embedded in the CSR notion. Therefore, CSR can constitute the framework and strategic corporate initiative to integrate sustainability triple bottom line principles (Epstein and Wisner 2001). Aligned with such consideration, IMO's latest stance visualizes that a sustainable maritime industry should be achieved by "inter alia, anchoring the vision of sustainable development into "Corporate Social Responsibility" (CSR) related activities" (Sekimizu 2012, p. 22). Thus, it is believed that understanding sustainability under the triple bottom line approach (social, economic and environmental) will, successively, shape sustainability as a notion that lies under the spectrum of the CSR strategy. It is, therefore, hypothesized that:

H1. *Considering sustainability as part of a company's CSR policy is closely related to sustainable development perception under the triple bottom line approach.*

3.2. Marine Safety Management Systems and Interactions with the Triple Bottom Line Approach

The purpose of a safety management system (SMS) is to establish a systematic approach, through which an organization will be able to effectively manage its risks. Depending on the business scope, an organization may face several risks including, health, safety, environmental, corporate, stakeholders, etc. (Cooper 2000). However, such requirement for organizations to establish and operate under an SMS is not something new. A historical flashback shows that development of safety management systems has, primarily, appeared in the outcome of catastrophic events. In 1974, the explosion of the

Nypro Ltd caprolactam production facility, in the UK, resulted to the formation of the Health and Safety at Work Act, which incorporated the first requirement to develop a safety management system (Gallagher et al. 2001). Introduction of the SMS, as a regulatory requirement, in the shipping industry became mandatory in 1998, when IMO's Resolution A741 (18) entered into force. Such progress appeared in the maritime arena in the aftermath of serious maritime disasters, such as the Exxon Valdez, Herald of Free Enterprise, Scandinavian Star and Estonia (Jedral 2000). Next, the International Safety Management (ISM) Code raised the requirement for management companies to develop a safety management system that would take into account applicable maritime legislation, relevant to the ship type, with the aim to ensure a safe, healthy, environmental friendly and, generally, risk free operation of their ships (El Ashmawy 2009).

Almost 20 years since the implementation of the ISM Code, the maritime industry is faced with multidimensional and critical issues. Amongst others, the introduction of the United Nations 2030 Agenda and 17 Sustainable Development Goals, call for systematic action with the aim to protect the planet, safeguard the life of seafarers, maintain efficient and affordable shipping services and ensure dignified living and working conditions for those working on board. Shipping has to transform its overall approach and, therefore, act and provide solutions to vital planet challenges, as embedded in the modern triple bottom line approach to sustainable development (Gjølberg et al. 2017). However, consideration and formulation of processes and practices in the shipping industry has been, mostly, governed and motivated by the attempt of shipping companies to comply with statutory maritime legislation (Acciario 2012). Safety, environmental protection and energy efficiency initiatives have been, highly, recognized and pursued by shipping companies as a mean to secure industry's sustainability, reduce business risks and promote company's image to stakeholders (Smith 2016). However, such pursuits have been, mainly, triggered by the need to comply with statutory maritime legislation and do not refer to a systematic approach to manage sustainability in an integrated manner (Kunnaala et al. 2013). Moreover, according to Yuen and Lim (2016), although the influence from newest sustainability developments in shipping is sensible, however, existing overloaded maritime regulatory regime is considered by shipping companies as a highly deterring factor in undertaking further voluntary, and beyond regulation, sustainability initiatives. Hence, it is assumed that the recent introduction of the triple bottom line approach in shipping will not transform such attitude and shipping companies will keep maintaining their traditional approach to SMS formulation (mainly, driven by statutory maritime legislation). As such, it was hypothesized that:

H2. *Companies' conventional approach to SMS formulation is unimportantly influenced by sustainable development introduction under the triple bottom line approach.*

3.3. Consolidated Management Systems and Sustainability Management

Development of a regime that stimulates involvement of private entities in philanthropic, environmental, social and anti-corruption activities has long been encountered in the international regulatory setting. However, SDGs envisage integration of social, economic and environmental objectives into a business strategy (Nilsson et al. 2016). The integrated management system (IMS) approach to sustainable development is a notion that seeks to consolidate the dimensions of the triple bottom line approach into operating practices of corporations (Searcy 2012). Having set the policy and management objectives, then, economic, social and environmental aspects of company's operations need to be addressed into detailed processes that prescribe specific directions, roles and responsibilities for every department and company's employee (Sroufe and Joseph 2017). Elements of commonly known Standards, such as ISO 9001 (quality management), ISO 14001 (environmental management), ISM Code requirements, along with requirement of other applicable maritime Conventions and Codes need to be brought together and balanced in an integrated management system (Oskarsson and Malmborg 2005).

Managing sustainability in an integrated manner lends the company with a unique advantage to manage its resources effectively (i.e., personnel, time and money), avoiding, thus, bureaucracy and procedure duplication (Asif et al. 2013). Furthermore, a critical for the company value, that of stakeholders, can be effectively considered by taking into account their particular interests and business aspects (Sealy et al. 2010). The triple bottom line approach to sustainability is by definition a multi-dimensional concept that, indirectly, sets the foundations for an integrated approach in managing and measuring sustainability. Such approach forms a dynamic managerial process that continuously takes into consideration a company's needs and challenges within the multifaceted business environment (Fauzi et al. 2010). At the strategic and corporate level, such an approach to sustainability is also identified and embedded in a corporate social responsibility business operating model (Dey and Sircar 2012). In line with such considerations, and within the maritime context, Poulouvassilis and Meidanis (2013) suggest that current sustainability mandates require broadening the scope of conventional marine management systems so as to incorporate economic, social and environmental concerns, along with stakeholders' expectations. Accordingly, it should be expected that sustainability awareness under the triple bottom line principles will, subsequently, motivate adoption of the integrated management system model, as the preferred tool to achieve sustainability. Under such consideration, it was hypothesized that:

H3. *Adoption of an integrated management system model as a mean to achieve sustainability is positively stimulated by sustainable development perception under the triple bottom line approach.*

4. Methodology

4.1. Research Strategy and Data Collection

Data gathering was done via an electronic questionnaire survey that was carried out among 50 shipping companies, based worldwide, and operating in the tanker and/or dry bulk maritime sector. The questionnaire was distributed to the email addresses of maritime personnel working in various departments, such as health, safety and environmental, technical, accounting/management, human resources and operations. The respondents were given the option to maintain their anonymity and at the end of the questionnaire they were provided with the space to share any personal experiences and thoughts. Data group is based on the collection of the type of data that will better inform our hypotheses and be appropriate to the research variables type (Johnson 2005). Given the fact that our study is concerned with the testing of developed hypotheses, our research follows a quantitative research approach and strategy. As such, the use of a questionnaire survey has been selected as the identical data collection method. Self-administered questionnaires allow us to collect quantifiable and measurable data from our drawn population sample, relatively quickly and cost effectively (Creswell and Creswell 2017). Both independent and dependent variables, concerned with hypotheses testing, relate to statements. Hence, participants were asked to state their level of agreement on such particular statements measured on a five point Likert (Strongly Agree to Strongly Disagree) and Guttman (Yes/I am not sure/No) scale. Moreover, descriptive statistics are employed to discuss demographics and provide general inferences of our collected data. Some indicant examples of questions used to test hypotheses refer to:

- Which topics should be part of a company's Corporate Social Responsibility (CSR) policy/program?
- Shipping operations are executed based on company's Safety Management System, which includes policies, objectives, plans, procedures, responsibilities and other measures. Taking into consideration your company's Safety Management System (SMS), please rate the importance of the provided elements (statutory regulations, CSR/sustainability standards, other industry standards i.e., ISO9001, ISO14001, etc.) to the formulation of your company's Safety Management System (SMS)? Please rank your preference.

- To what extent do you agree with the following statement: Sustainable shipping operations can be effectively achieved by adopting an integrated management system approach that consolidates and balances the requirements of various voluntary standards (i.e., ISO9001, ISO14001, OHSAS18001, etc.) and statutory regulations (i.e., ISM, ISPS, MLC, etc.) into business operations.
- To what extent do you agree with the following statement: Sustainable development is understood as the conduct of business in a way that a company's economic, social and environmental impacts are considered and, as such, business activities are performed transparently and with the aim to eliminate social and environmental risks.

A summary of dependent and independent variables are presented in Table 1.

Table 1. Independent and dependent variables and corresponding hypotheses.

Alternative Hypothesis	Independent Variable	Dependent Variable	Test
H ₁ : Considering sustainability as part of a company's CSR policy is closely related to sustainable development perception under the triple bottom line approach.	Sustainable development perception under the triple bottom line approach. (ordinal)	Considering sustainability as part of a company's CSR policy. (nominal)	Chi-square test of independence
H ₂ : Companies' conventional approach to SMS formulation is unimportantly influenced by sustainable development introduction under the triple bottom line approach.	Sustainable development introduction under the triple bottom line approach. (ordinal)	Companies' conventional approach to SMS formulation. (ordinal)	Spearman's correlation coefficient
H ₃ : Adoption of an integrated management system model as a mean to achieve sustainability is positively stimulated by sustainable development perception under the triple bottom line approach.	Sustainable development perception under the triple bottom line approach. (ordinal)	Adoption of an integrated management system model to achieve sustainability. (ordinal)	Spearman's correlation coefficient

4.2. Data Analysis Method

Both descriptive and inferential statistics methods were employed to summarize results and verify hypotheses. The type of variables and collected data was used as a criterion for the selection of the most appropriate hypothesis testing method. In particular, Hypothesis 1(H1) was tested using a chi-square test of independence. Chi-square test of independence, or Pearson chi-square test, is a non-parametric test, suitable for the testing of hypotheses, which include at least one variable measured on a nominal scale (McHugh 2013). A chi-square test provides evidence on whether there is a statistically significant relationship between groups or variables. Therefore, depending on the test results, at the level of significance $\alpha = 0.05$, we reject the null hypothesis if the p -value is less than α ($p < 0.05$; Rana and Singhal 2015). Further, a chi-square test of independence is coupled with a contingency coefficient (C) measure. Contingency coefficient (C) is termed as a measure of association that is used to determine the strength of relationship between our variables. Values close to -1 indicate a strong negative association, while values close to 1 show a perfect positive association. Values of 0 imply no relationship between variables (Tan et al. 2004). Hypotheses 2 (H2) and 3 (H3) were tested using Spearman's correlation coefficient measure. The nature of our selected variables, which were categorical measured on an ordinal scale, allowed us to use such a statistical measure to verify the statistical significance between our variables. As per Spearman, a statistical significant relationship between variables exists when the p -value is less than 0.05 (where α , the level of significance) and, therefore, the null hypothesis is rejected (Myers and Sirois 2004). Spearman's correlation coefficient (Rs) also enables us to determine the strength of association between selected variables. Rs values range between $-1 < R_s < 1$. Values close to -1 imply a strong negative association, while values close to 1 inform us for the existence of a

strong positive relationship between variables. A value close to 0 implies no relationship between variables (Rebekić et al. 2015). The Statistical Package for Social Sciences (SPSS) version 25 for windows was used for the elaboration of collected data. Summarized hypothesis, dependent and independent variables, along with specific statistical measures employed in this study are presented in Table 1.

5. Results

5.1. Demographic Data

Out of the 50 respondents, 38 (76%) were males, with the remaining 12 (24%) of the sample population being females. Most of the personnel belonged in the age groups of 41–50 and 51+, accounting for 34% and 32% respectively. The majority of companies' fleet size ranged between 1–20 and 61+ vessels corresponding to 42% and 34% respectively. Participating companies' size, in terms of employee number, was 251+ (58%) and 51–150 (20%), while the remaining accounted 151–250 (14%) and 1–50 (8%). Among all the respondents, 32 (64%) held positions in the QHSE department, six (12%) hold positions in the human resources department, while five (10%) and two (4%) work in the technical and accounting/management division respectively. Forty-one (82%) declared to have incorporated into the company's policy CSR principles, while five (10%) answered that no CSR principles were embedded into their organization. Surprisingly though, only 2% found to be officially certified against a CSR/sustainability standard, while the majority inclined towards environmental, quality and health management standards certification (73%). Similarly, the majority of respondents (72%) employed an integrated health, safety and environmental report as a mean to measure and communicate business performance, while 16% opted to generate a dedicated annual sustainability report. With regards to the companies' nationality, 11 (22%) were based in Norway, 10 (20%) in Greece, seven (14%) in Denmark, four (8%) in Germany, four (8%) Cyprus, three in Finland (6%), two in Canada (4%), two in Switzerland (4%), two in The Netherlands (4%), while the remaining five were based in countries such as Monaco, Turkey, Sweden, Belgium and Italy. Review of such results provides a clear indication that a sizable number of participants occupied positions in departments that exposed them directly to sustainability matters and, moreover, they came from diversified backgrounds and had acquired sufficient work experience. Furthermore, participating companies were large in size, in terms of vessels number under management and employee number, and were based in a variety of countries, a fact that did not constrain our conclusions to the findings of a single country.

5.2. Hypothesis Testing Results

The statistical significance of hypothesis 1 variables was tested. Further to the application of chi-square test of independence, obtained p -value was $0.022 < \alpha$. A statistically significant relationship between variables had been identified, with $\alpha = 0.05$ being the level of significance. Therefore, the null hypothesis was rejected ($X^2(8) = 17,859, p\text{-value} = 0.022$). As such, on the basis of the data, it was found that perceiving sustainable development under the triple bottom line approach was significantly related to the consideration of sustainability as part of a company's CSR policy and management strategy. Furthermore, according to the application of the contingency coefficient measure, the estimated C value was 0.513. Such a result suggests the existence of a quite positive association between selected variables. More precisely, it was implied that the more we understand sustainable development under the triple bottom line approach, the more we consider sustainability as being part of a company's CSR policy and management strategy. Table 2 presents a summary of results from testing hypothesis 1.

Table 2. Hypotheses 1 Testing: Chi-square test of independence and contingency coefficient measure.

Null Hypothesis	<i>p</i> -Value	X^2	Contingency Coefficient (C)	H ₀ Rejected (α < 0.05)
H ₀ : Considering sustainability as part of a company's CSR policy is not closely related to sustainable development perception under the triple bottom line approach.	0.022 *	17,859	0.513 **	Yes

Notes: * H₀ rejected at significance level $p < 0.05$ ** $-1 \leq C \leq 1$, -1 = perfect negative relationship, 0 = No relationship, 1 = perfect positive relationship.

On the basis of the analyzed data, we did not find support for Hypothesis 2, which assumes that the recent introduction of sustainable maritime development under the triple bottom line approach, is not expected to have altered companies' conventional approach to SMS formulation. From the application of Spearman's correlation measure, the obtained *p*-value was $0.343 > 0.05$ (at level of significance α), which shows the non-existence of a statistically significant relationship between variables. As such, the null hypothesis was retained. Moreover, the estimated *R_s* value was 0.137 , which indicates the almost absent association between variables. Further to that, introducing sustainable development under the triple bottom line approach was expected to have influenced the degree that statutory maritime regulations occupy to the formulation of company's SMS raising, thus, incorporation of further sustainability provisions and standards. Results from testing hypotheses 2 are presented in Table 3.

Table 3. Hypothesis 2 Testing: Spearman's correlation measure.

Null Hypothesis	<i>p</i> -Value	Spearman's Correlation Coefficient (R _s)	H ₀ Rejected (α < 0.05)
H ₀ : Companies' conventional approach to SMS formulation is not unimportantly influenced by sustainable development introduction under the triple bottom line approach.	0.343 *	0.137 **	No

Notes: * H₀ rejected at significance level $p < 0.05$ ** $-1 \leq (R_s) \leq 1$, -1 = perfect negative relationship, 0 = No relationship, 1 = perfect positive relationship.

On the basis of obtained data, we found support for hypothesis 3. Hence, perceiving sustainable development under the triple bottom line approach was significantly related to the adoption of the integrated management system model as a mean to achieve sustainability. Therefore, testing of hypothesis 3 implies a statistically significant relationship between variables. Accordingly, obtained values from the application of Spearman's correlation measure generated a *p*-value of $0.000 < 0.05$ (at level of significance α). In view of that result, the null hypothesis was rejected. Moreover, a quite positive association had been identified, as indicated by the obtained *R_s* value of 0.519 . In that sense, raising companies understanding of sustainable development under the triple bottom line approach positively increased their inclination towards the integrated management system model, as the best mean to achieve sustainability. Results from testing hypotheses 3 are presented in Table 4.

Table 4. Hypothesis 3 Testing: Spearman’s correlation measure.

Null Hypothesis	<i>p</i> -Value	Spearman’s Correlation Coefficient (R_s)	H_0 Rejected ($\alpha < 0.05$)
H_0 : Adoption of an integrated management system model as a mean to achieve sustainability is not positively stimulated by sustainable development perception under the triple bottom line approach.	0.000 *	0.519 **	Yes

Notes: * H_0 rejected at significance level $p < 0.05$, ** $-1 \leq (R_s) \leq 1$, -1 = perfect negative relationship, 0 = No relationship, 1 = perfect positive relationship.

6. Discussion

Overall, data analysis implied verification of hypotheses 1 and 3, while hypothesis 2 was rejected. The triple bottom line approach to sustainable development is highly diffused in the shipping industry and is considered as being part of a company’s wider CSR policy. In that sense, the integrated management system was indicated as the preferred model to achieve sustainability. However, perceiving sustainability in an integrated manner (environmental, social and economic) does not necessarily constitute statutory maritime legislation as the sole determinant source to marine safety management systems formulation. Deductions and inferences are discussed below.

6.1. Triple Bottom Line Approach to Sustainability and CSR Correlations

Confirmation of hypothesis 1 found to be in line with previous research findings. Thereby, it was affirmed that supporting a sustainability mindset as an integrated triptych will promote awareness of sustainability as a notion anchored and achieved through a wider CSR management strategy. Such deduction is in accordance with existing research which, mostly, regards CSR as a business management model set at strategic level that aims to integrate environmental, social and economic pursuits within the organization (Saha and Dahiya 2015). It is worth noting at this point that the sustainability notion has been frequently termed as corporate sustainability reflecting, thus, a company’s strategic approach and commitment to sustainable development (Dyllick and Hockerts 2002). However, despite such diverse employed terminology, confirmation of hypothesis 1 showed that the more companies deal with sustainability as an integrated notion, the more they perceive it as being part of a wider CSR corporate strategy (Aras and Crowther 2008). Latest industry’s regulatory and policy efforts to address sustainability in its three dimensions and embrace it under the ‘umbrella’ of a CSR business model seem to have shaped shipping sustainability perception. Consequently, shipping industry has recognized that the multifaceted challenges of sustainable development today require a strategic approach. Such understanding has, possibly, driven companies to realize that sustainability initiatives within an organization should be placed under a CSR policy (Gjølberg et al. 2017; Poulouvassilis and Meidanis 2013). Further reviewing the latest IMO’s inherent policy stance in conjunction with study findings, it was ascertained a harmonization of maritime companies’ CSR and sustainability attitude with such IMO’s inspiration. Indeed, as discussed above, contemporary sustainability developments and, specifically, UN’s 2030 Agenda and SDGs, have introduced an integrated approach in sustainability management for private corporations. Actually, the integrated term of the sustainability concept does not refer to a recent discovery since it has been identified long before, by Elkington, during the 1990’s, and has been commonly acknowledged as the triple bottom line approach (Purvis et al. 2018). However, today, and keeping up with recent policy and regulatory changes, the study findings supported shipping companies’ wide sustainability perception as an integrated notion (triple bottom line approach) embedded into CSR, an assumption fully aligned with contemporary IMO’s viewpoint (namely that every sustainability action should be framed into a CSR policy framework; Sekimizu 2012).

6.2. Marine Safety Management Systems and Interactions with the Triple Bottom Line Approach

Hypothesis 2 explored the association between sustainable development perception under the triple bottom line approach and how likely it was to affect the extent that provisions of statutory maritime legislation occupy in the formulation of companies' SMS. Understanding sustainability in an integrated manner is definitely a reality in shipping. Literature review and empirical investigation supported that the maritime sector had acknowledged sustainable development in its three dimensions, which was, furthermore, in line with UN's and IMO latest regulatory developments (Sekimizu 2012). However, we found no support between the association of sustainable development understanding in its three dimensions and deployment of the provisions of statutory maritime legislation as the principal regulatory source to SMS formulation. As such, hypothesis 2 was not confirmed. Interpreting further such a finding, we have to admit that the issue of quality, safety and environmental protection in merchant shipping has been, customarily, identified with compliance against minimum statutory maritime legislation, such as SOLAS, MARPOL, ISM Code, etc. (Kunnaala et al. 2013). As a matter of fact, and on a general level, the foundation and structure of marine safety management systems has been, mainly governed by statutory maritime legislation, reflecting, thus, the industry's overall culture and approach to the whole issue (Ships 1994). Initially, evolutions in the field of sustainable development and current promulgation of such a notion in an integrated manner were believed not to have affected the traditional approach of maritime companies to SMS formulation. However, and contrary to hypothesis 2's initial assumption, empirical results debated such reasoning. A sensible explanation of this would stem from the fact that shipping companies, operating in an international and changing environment, have sought to adapt their traditional approach to SMS formulation. In that way, they have moved one step forward and realized that effective sustainability management, nowadays, requires integration into SMS of several social, environmental and economic elements and principles that up to now had been, possibly, out of the scope of shipping business. Thus, dissemination of the sustainable development concept in an integrated manner has, without doubt, altered their conventional approach to SMS formulation. Hence, shipping companies, driven by current sustainability challenges and awareness, seem to have renovated their safety management system approach by incorporating sustainability elements, apart from customary maritime legislation (Gjølberg et al. 2017).

6.3. Consolidated Management Systems and Sustainability Management

A positive relationship was hypothesized to exist between sustainable development understanding, under the triple bottom line approach, and the adoption of the integrated management system model as a mean to achieve sustainability. Further to that, hypothesis 3 was confirmed. Moreover such an association was found to be quite strong. Further to the introduction of UN's 2030 Agenda, in 2015, the sustainable development concept has been obviously introduced in an integrated manner (Griggs et al. 2013). The literature review confirmed the profound diffusion of such an approach in shipping, which was found to be in line with our empirical investigation results. Identification of the integrated management system approach to manage sustainability management has been previously identified as an effective and strategic tool for organizations (Azapagic 2003). In that sense, combination of several aspects and elements from various standards and statutory regulations and their later integration into company's safety management system, has proved to be a flexible and cost-effective tactic to manage business risks, stakeholders' relations and, thus, contribute to a company's overall sustainability (Başaran 2018). Similarly, study results implied that the integrated management system approach was highly rated by shipping companies as a mean to manage sustainability challenges, with such being attitude reinforced by the growing sustainability perception under the triple bottom line approach. This is, potentially, explained by the fact that up-to-date multilateral and multidimensional aspects of the sustainable development concept require homogenous, well-structured and integrated solutions to be achieved. Therefore, the integrated management system model turns out to be a tested and reliable solution to avoid duplication, ensure flexibility, eliminate process fragmentation and

increase organization's overall efficiency (Hong 2017). Hence, shipping companies, appreciating the ever increasing and complex social, environmental and economic challenges, at the international and regional level, indicate IMS as the most effective mean. Further to the identification of a strong enough association between hypothesis 3 variables, it is supported that the more complicated and demanding sustainability challenges will become, the more shipping companies will be tending to the choice of the IMS solution.

7. Study Implications

The aim of this study was to explore the concept of the triple bottom line approach to sustainability, in the aftermath of the recent introduction of UN's 2030 Agenda and Sustainable Development Goals in shipping. Therefore, identified gaps, along with growing dissemination of sustainable development under its three dimensions, has motivated us to assess tanker and dry bulk sector's adaptation to such newly hosted tendencies. In summary, literature review conclusions, coupled by empirical research results, suggest two major implications.

Firstly, the theoretical added value of this paper has made it possible to enrich our knowledge and reach a deeper understanding on sustainable development configuration in the maritime sector, in the light of the lately promoted triple bottom line approach and UN's Sustainable Development Goals in shipping. Findings suggest that sustainability is broadly understood as an integrated element (environmental, social and economic), which is embedded into a company's broader CSR policy and management strategy. Regulatory and policy level developments have shaped sustainability in shipping under the triple bottom line notion, which, additionally, has urged shipping companies to consider CSR as the vehicle to achieve sustainability throughout their operations. Furthermore, such a tendency has affected their 'traditional' safety management system approach, which was initially based on the provisions of statutory maritime legislation. Under this new reality and mindset on sustainable development, it is also implied that shipping companies have well started adapting their traditional SMS approach, by integrating elements of other environmental, social and economic Standards. Moreover, another implication to knowledge suggests that identification of sustainability under the triple bottom line approach has obviously stimulated the acknowledgement and dissemination of the integrated management system model as the most effective management pattern to achieve sustainable maritime operations.

Secondly, this study may provide useful input to regulators and policy makers in designing and prioritizing their regulatory chases and focus areas. Research findings suggest that corporate social responsibility may serve as a key contributor and vehicle to the achievement of sustainable development. Such a fact signalizes a clear indication to regulators and policy makers with regards to their future areas of concern and action. Thus, understanding sustainability as part of a CSR policy and strategy demonstrates that UN Sustainable Development Goals could be better achieved by further circulating CSR principles in the shipping sector. Practically, such a deduction should be translated to the diffusion and promotion of integrated CSR business models in shipping so as to address current sustainability challenges. However, the fact that the shipping industry appears not so keen to the adoption of official CSR/sustainability standards certification, measuring and reporting systems should constitute a concern area for regulators and policy makers, which are urged to consider and promulgate the integrated management system model as the most effective mean to achieve sustainable operations. Such advancement though, should maintain a voluntary character without necessarily being accompanied by the establishment of a mandatory CSR and sustainability regime for the maritime sector. Further awareness, training and guidance on CSR and sustainability instruments and aspects should, therefore, constitute the principal focus areas and action field for regulators and policy makers.

8. Conclusions: A Conceptual CSR Framework for the Achievement of a Sustainable Maritime Industry

Bearing in mind the literature review assumptions and coupled by the study findings, it was assumed that CSR could lend shipping companies with a strategic management tool to contribute to the fulfillment of United Nations' Sustainable Development Goals and subsequent IMO's Strategic Directions for the achievement of a sustainable shipping industry. CSR should be, primarily, seen as the vehicle to deal with sustainable development requirements and fulfill stakeholders' demands. In that respect, CSR requires deep knowledge, broad interpretation and extensive integration of SDGs, IMO's strategic directions, Flag Administration rules and other industry requirements into a company's processes. Moreover, key stakeholders' expectations (employees, suppliers, charterers, labor unions, local community) should be analyzed and their concerns be integrated into business processes. Equally important is the integration of principles and requirements of individual management systems and industry standards to facilitate company's goals. As a matter of fact, multiple systems and standards exist to deal with efficiency, environment, social accountability and occupational safety. In such a plethora of regulations and management standards, the use of fragmentary and isolated management systems would compromise efficiency and, additionally, would bring confusion at the employee and operational level. Therefore, a company's SMS needs to be filtered and relevant requirements to be integrated and adjusted to company's objectives, business profile, management culture, and overall commercial potential. Practically, job manuals, procedures, processes and instructions need to be written and communicated to employees in a manner that avoids duplication and confusion, promote efficiency, address stakeholders and sustainability needs and, moreover, can be measurable and auditable at any time (Asif et al. 2013).

In the light of such argumentation, the below proposed conceptual CSR framework depicted in Figure 1, suggests a structured pathway on how CSR can be structured into business operations. Such conceptual approach commences at the top management level with the dissemination of CSR into the strategic management objectives and processes (Matten and Moon 2008). Firstly, it is imperative the creation of a CSR strategy that places sustainability at the core of business. Secondly, it is vital the integration of CSR principles into a company's business activities, through the appropriate transformation of the safety management system, in such a way that a company's economic objectives are balanced with stakeholders' expectations, societal anticipations and environmental challenges (Zwetsloot 2003). Thereafter, CSR implementation will continue with the integration of existing management systems to meet stakeholders' requirements. The whole process will be concluded, thereupon, at the operational level by setting work instructions and procedures that promote efficiency, ensure a safe workplace, respect the environment, consider the society and manage stakeholders' requirements (Asif et al. 2013). However, in order such an attempt to be productive it has to be systematic, measurable and clearly defined into core business strategy, processes and objectives (Burke and Logsdon 1996).

Figure 1 summarizes the foremost phases, as described above, to be passing through in order to create and integrate CSR into a company's shipping operations.

It is worth reminding at this point that as per obtained study results, dedicated CSR measuring and reporting has not been a practice widely followed by shipping companies. In contrast, shipping companies, customarily, generate an integrated health, safety and environmental report, mainly for internal use. However, ship managers can benefit from CSR measuring and reporting in many forms, one of which is the increased trust and improved company's image and relationships with stakeholders (i.e., Charterers, local communities, Port State Controls, Flag Administrations, etc.). Hence, in order for CSR to be fruitful, it should be practically addressed through quantifiable and defined indicators, tailored to the requirements of sustainable development (economic, social and environmental) and stakeholder pursuits (Schaltegger and Wagner 2006). The Global Reporting Initiative framework can provide a suggestive example of CSR measuring and reporting standards. However, selection of CSR measurement indicators is a decision that should be taken according the individual characteristics

of each company and measurement of CSR performance should be followed by CSR measurement and reporting (Toppinen et al. 2012). Measuring and reporting CSR performance can provide ship managers with an overview of the success of their CSR and sustainability initiatives, highlight areas of improvement and assist in the reassessment and orientation of a company's strategy. Ultimately, according to Figure 1, CSR audit is a valuable tool that provides a snapshot of the implementation state of company's corporate mandates and strategic objectives. Audit results can be later evaluated and decisions taken on where an improvement effort should be undertaken (Asif et al. 2013).

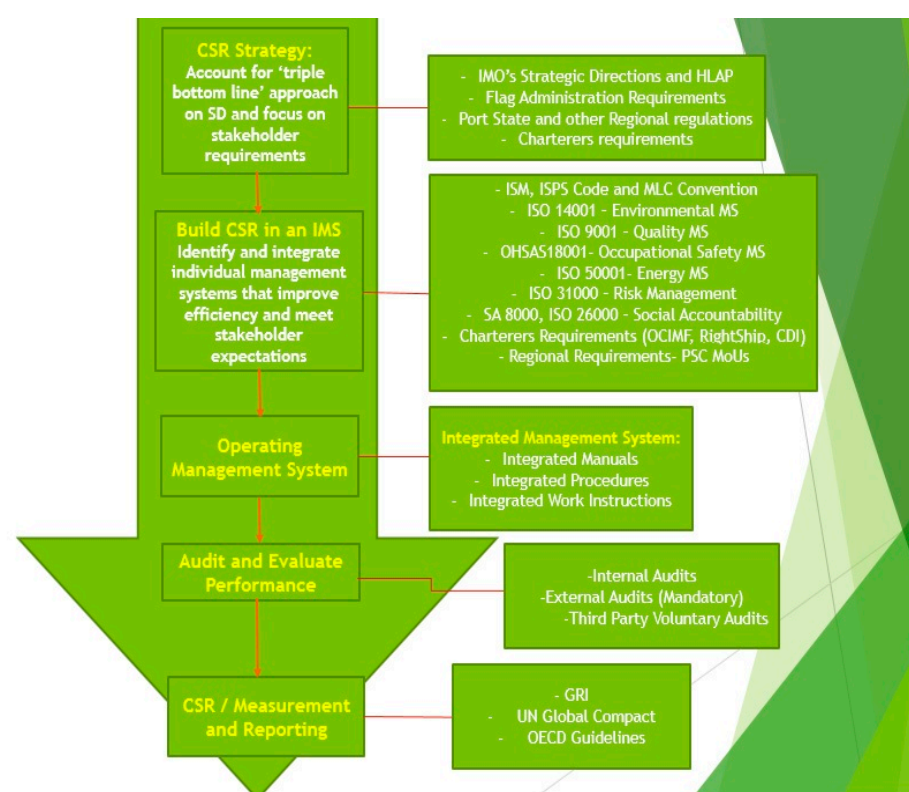


Figure 1. A conceptual corporate social responsibility (CSR) framework for a sustainable maritime industry.

9. Limitations and Future Research

Limitations to this study were primarily concerned with the employment of a questionnaire survey. Specifically, the use of this data collection method did not give the space for open-ended questions and might cause misinterpretations of the answers. Moreover, our research approach and design did not allow us to examine policies, procedures and processes of shipping companies with regards to CSR and sustainability. Thus, such a fact bears some subjectivity to the interpretation of the results. To that end, future studies are recommended with the aim to collect and provide more qualitative information and insights on current perceptions and practices employed by companies in their attempt to operate sustainably. A future qualitative approach and research, possibly through case studies, interviews, observations and document review is recommended as a mean to overcome identified limitations and propose CSR and sustainability best practices.

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