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Research Paper

Sustainability in the maritime industry, challenges, and solutions

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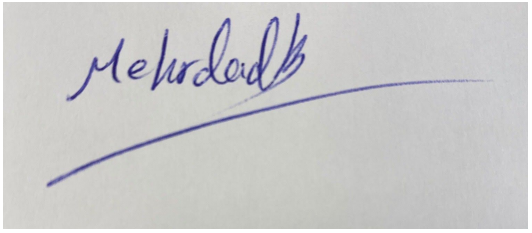

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List of Abbreviations

BAF	Bunker adjustment factor
BIMCO	The Baltic and International Maritime Council
BV	Bureau Veritas
EEDI	Energy Efficiency Design Index
EGCS	Exhaust Gas Cleaning System
GHG	Greenhouse Gas
HFO	Heavy Fuel Oil
ICS	International Chamber of Shipping
IMO	International Maritime Organization
ISF	International Shipping Federation
LNG	Liquified Natural Gas
LSFO	Low Sulphur Fuel Oil
MARPOL	International Convention for the Prevention of Pollution from Ships
MDO	Marine Diesel Oil
MEPC	Marine Environment Protection Committee
NGO	Non-Governmental Organization
RINA	Registro Italiano Navale
SEEMP	Ship Energy Efficiency Management Plan
SOLAS	International Convention for the Safety of Life at Sea
TEU	Twenty-foot Equivalent Unit
UNCTAD	United Nations Conference on Trade and Development
VLSFO	Very Low Sulphur Fuel Oil

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Abstract

The shipping industry at present is facing different challenges including the new IMO legislation, security issues, geopolitical shifts, technological changes, and the demand for higher sustainability. While these challenges more likely bring a broad range of impacts to the whole industry in terms of economical, environmental, and social aspects, they could be seen as excellent chances to elevate the maritime industry, and sustainability plays a particular role in between, as it is recognized as a global serious issue. Since 2015, the United Nations members took an initiative by adopting 17 sustainable development goals as a plan of action to tackle indigence and protect the environment and earth to make sure that human beings will live in peace and happiness by the end of the 2020s. While 90 % of the products in the world are shipped by ships, global shipping is one of the pioneer industries, which drives prosperity and empowers the nations to promote the growth of their economy. However, the industry is struggling with some significant challenges in terms of economic, environmental, and social, which are overshadowing this prominent role, if they are not addressed properly. Based on the review of literature on sustainability in the maritime industry and the globalization and stakeholder's theories, a questionnaire is designed and an interview has been conducted among the primary stakeholders of the shipping industry. Analysis of the interviews demonstrates that there is a need for a holistic approach within the industry. Equal cooperation between the states, private sector, NGOs, academic communities and the people on one side and utilization of the technology appropriately and brightly on the other side and using the fresh talents and hard work are essential to find out the competitive strategies and overcome the conflict of interests across the maritime sector to achieve the sustainable developments goals and maintain them in long term.

1. Introduction

Context

While one of the main challenges of every industry is sustainability and greenhouse gas emissions, the shipping industry, with 53000 ships and transportation of 90% of global trade generates 3 % of total global greenhouse gas emissions per year, which is the lowest amount in the commercial transport segment in comparison to the road and air transport, and this contribution to greenhouse gas emissions may be the minimal footprint(Speirs et al., 2020). However, the shipping industry cannot remain untouched due to the increasing attention on environmental matters.

Focus & Scope

Shipping releases different substances, which pollute the environment and have a direct harmful impact on the environment and global warming, including Carbon dioxide, Sulfur oxides, Nitrogen oxides, Carbon monoxide, volatile organic compounds, and particulate matter like black carbon.

Nevertheless, the international maritime industry is expected in the future to account for about 19% of global emissions in the case that it does not take appropriate reduction measures (Gallo, Moreschi, Mazzoccoli, Marotta & Del Borghi, 2020). In addition, international shipping is one of the key drivers of climate change, with the contribution of 21% of CO2 equivalent emissions to climate change in 2015, through emissions of black carbon, which is produced by the combustion of marine fuel(Comer, Olmer, Mao, Roy & Rutherford, 2017).

After replacing the Kyoto protocol with the Paris agreement in November 2016, all committed countries are required to take a holistic approach regarding GHG emission reduction, especially in their economic targets, and the shipping industry is a key part of that.

Whereas global shipping is not included in the Paris Agreement yet, the International Maritime Organization (IMO), as the main ruler of the maritime industry, is actively engaged in a global approach to give support to this agreement and managed to implement a set of strategies to reduce the carbon emissions of the shipping sector. The main objective is to improve the

ship's energy efficiency and develop measures through its committees to reduce GHG emissions from ships(Serra & Fancello, 2020).

Relevance & Importance

Emissions from international shipping could increase between 50% and 250% by 2050, mainly due to the growth of the world maritime trade (IMO, 2020). Hence, IMO's Marine Environment Protection Committee (MEPC) is taking different actions to tackle GHG emissions by enacting new regulations and measures like the Energy Efficiency Design Index (EEDI) or the Ship Energy Efficiency Management Plan (SEEMP), which came into force in 2013 and applied to all types of vessel, which has more than 400 MT gross tonnage and above(Joung, Kang, Lee, & Ahn, 2020). Besides, the European Union set a series of goals to decrease GHG emissions by 2050 through the climate and energy 20-20-20 package and the 2030 climate and energy framework. The main purpose is reducing at least 40% of GHG emissions by 2030 (Gallo, Moreschi, Mazzoccoli, Marotta & Del Borghi, 2020).

In addition to the GHG emissions, Ballast Water Management can be named as another serious problem of the maritime sector. The International Maritime Organization´s Ballast Water Management Convention came into force globally in 2017 to avoid the extension of microorganisms, which might be harmful to different ecosystems. The treaty includes D1 and D2 standards. While D1 standard enforces the vessels to exchange their ballast water in open seas and outside of the port limits, D2 standard determines the highest volume of organisms, which ships are permitted to discharge to the open sea and induce the vessels to have a ballast water management plan, a book to keep all the records as the reference and also an International Ballast Water Management Certificate and all vessels must comply with the D2 standard latest by September 2024(IMO, 2020). However, there are still challenges to implement the convention in terms of regulations and legislations in different countries and jurisdictional differences about the sea boundaries and limits, management systems and technology and safety of navigation, which need to be addressed in an efficient way(Weintrit & Neumann, 2019).

Another current challenge of the industry is digitalization and automation. The shipping industry is one of the proactive industries in terms of using the new technologies and artificial intelligence and implementing them within the industry and, nobody is surprised by hearing of some concepts like Smart shipping and unmanned vessels, Smart ports, or using blockchain technology

for the document exchange activities. However, there are still many important questions and concerns, which need to be answered and addressed, enabling the key stakeholders of the industry to get convinced enough for the implementation of the new systems. For example, the document exchange part of each shipment for the majority of the shipments are still paper-based because of lack of infrastructure and also lack of trust mainly because of security concerns, while the documentation process could be done over the blockchain platform(Kapnissis, Leligou & Vaggelas, 2020).

Also, another concern would be human factors. For instance, while the vessels and ports become more automated, then who will be responsible for any issues, which may happen during sailing time or operation? Or to what extent the cargo carrier will be liable if any issues arise on board the vessel? How about the complexity of the system or cyber-attacks and many other questions, which deserve to be explored more with the right mindset and open-mindedness(Alop, 2019).

Last but not least is cost and investment in the maritime industry. Concerning to comply with the new legislation and regulations and maintain sustainability in the industry by using the new technologies and trends, which impose a huge cost on the shipowner's shoulders, there is an undeniable need for investment from the primary stakeholders, who are not limited to the shipowners only and put various challenges ahead of the global shipping, since the industry must fulfill its sustainability obligations in terms of environmental and social and remain profitable at the same time(Ouyang, 2020).

Questions & Objectives

Although the sustainability topic in the literature has been studied a lot since a couple of years ago and brilliant results have been generated for both the scientific community and the maritime industry, inadequate attention has been paid to different pillars of sustainability to achieve comprehensive solutions and tackle them accordingly. Economical concerns are still the main problem and the whole industry is still struggling with many challenges, while environmental and social aspects are still lagging. Also, geopolitical conflicts between the west and east and over-regulation by different regulatory agencies like IMO or EU, which are implementing strict regulations on a regular basis without consideration of lack of infrastructure and financing, have been putting the maritime industry at risk permanently. As an example,

global sulfur emission control came into force at the beginning of 2020, which forced all types of ships to burn a type of marine fuel, which its sulfur content is not allowed to exceed 0.5% without providing the required infrastructure, facilities, and convenient solutions, which is putting the shipowners under pressure to taking one of the three current existing approaches, which are using LSFO(Low sulfur fuel oil), placing of scrubbers on board of the ships by purchasing them or hiring them or using LNG(Liquified natural gas) as the bunker, which will impose huge costs even in short term or may not be able to protect the environment as planned(Ouyang, 2020).

This study is going to assess the current condition of sustainability strategies and solutions in the maritime sector and sea logistics and scrutinize how the IGOs, Conventions, and agreements, like the International Maritime Organization (IMO) or Paris Agreement, can impact the industry through the adoption of new legislation or amendment to the existing laws. Furthermore, it will evaluate whether these current and coming regulations will lead to a more sustainable environment and the industry or not. Also, what kind of strategies can be implemented to bring more tangible impacts and how can we identify the most efficient solutions among them? Finally, the study will investigate the consequences of regulations and whether these rules are a threat or opportunity for ship owners, the maritime industry, and their main stakeholders.

Overview of the structure

This paper is structured into 5 sections. Following the introduction, the second section is the literature review and will assess the existing published theoretical and empirical information in terms of the different aspects of sustainability and the opportunities, obstacles, challenges, and solutions in order to provide a better understanding of the current conditions of the industry. Section three will discuss the research method and explain the investigation in detail, which will follow the qualitative methodology by making a questionnaire and approaching the primary stakeholders of the maritime industry and interview with 19 different experts in a semi-structured way, who are including shipowners, ship agents, ports estates control, marine lawyers, Class societies, flags estate, charterers, and shipyards in order to find out in-depth the main challenges, concerns, barriers and solutions from different perspectives, which must be taken into account by the main stakeholders. The fourth section will describe the findings and outcomes of the research and

lastly the conclusion part, which summarizes the result, limitations, and recommendation.

2. Literature Review

Background and history

While one of the main discourse of any industry is sustainability, many recent research projects in the shipping industry regarding the GHG effect and CO2 emission have been focusing on vessels and replacement of fossil fuel with non-petroleum-based fuels like LNG, Methanol, or Ammonia as the best solution to reduce GHG and CO2 emission. Different studies mentioned that air pollution in the maritime industry is because of burning fuel oil by the ships and also oil-consuming equipment on both the vessels and the shore side. In addition, there is a lot of literature on the investigation of strategies for reduction of emissions from different types of ships, which are also covering the port sides as well(Li et al., 2018). These investigations also include zero-carbon shipping (Urban et al., 2018), utilization of different marine fuel, like LNG(Wu et al., 2018), implementation of strategies and legislation in terms of green shipping(Shi et al . , 2017), and Penalties for non-compliance in the maritime sector(Lähteenmäki-Uutela et al., 2019). Besides, IMO as the main regulatory agency of the maritime industry has been enacting and implementing different legislations and conventions on behalf of the United Nations like CO2 emission, Ballast water management, MARPOL as the international convention for the prevention of pollution by ships, SOLAS as the International Convention for the Safety of Life at Sea, EEDI(Energy Efficiency Design Index), which is obligatory for the new ships, or SEEMP(Ship Energy Efficiency Management Plan), which is mandatory for all vessel and so on, to enforce the ship owners and shipyards to incorporate required systems and technologies on the vessels in order to meet the requirement of the new regulations (Trivyza, 2020).

New Regulations and solutions

In addition to the regulatory agencies like IMO or EU, market elements, and risk of lack of resources and environmentalist pressures are the main drivers of sustainability in this sector(Serra & Fancello, 2020).

One of the new regulations entered into force since January 2020 is new sulfur emissions limits, which has to be 0.5% globally and 0.1% in IMO-designated emission control areas and in order to meet such requirement, and in terms of technological measures, there are 3 options of using LSFO(Low Sulphur Fuel Oil) instead of HFO(Heavy Fuel Oil), using scrubbers and burning LNG instead of fossil fuel. In addition, there are some other measures too, like operational measures, which are focusing on the speed management of the vessels by the slow steaming approach to decrease the fuel consumption or route optimization and also market-based measures, like imposing a tax on the ships, which are burning HFO or incentivization of the ships, which are using alternative fuels or other technological measures(Serra & Fancello, 2020).

To summarize the aforesaid technological solutions, replacing HFO with LSFO is the easiest way among these 3 approaches and there is no need to change the technical structure of the vessels a lot except for some changes in the fuel system, enabling vessel to sail efficiently, which does not take too much time and ship owners and ship management companies are able to implement that to fulfill their obligation in terms of sulfur emission control(Ouyang, 2020).

Another approach is placing EGCS(Exhaust Gas Cleaning Systems), which are called scrubbers too on board the vessels. The scrubber is a pollution control machine, which is washing the exhaust gases from the main engine, auxiliary engine, and boilers by using fresh water in close loop models(which is appropriate for a short distance only) or seawater in open-loop models, in order to eliminate the Sulfur dioxide gas(Shippipedia, n.d.). As there is a significant difference between the price of HFO and LSFO and buying it in long terms may put a huge cost on the shipowners, and this difference could be increased even more after 2020, some shipowners decided to install scrubbers on board of the vessel and continue to buy HFO, despite this fact that the unit price of scrubber depends on the model and type, could be around USD 3-5 million dollars. However as the price differential between HFO and LSFO or VLSFO is expected to become more, such investment is going to be more interesting, and return on investment could be faster. The Mediterranean Shipping Company has the largest fleet of vessels, with more than 50 vessels, which have been equipped with scrubbers(United Nations Conference On Trade And Development, 2020).

The third approach is the burning of alternative fuels, like LNG or methanol. According to some research projects, by burning LNG, the CO2 emission can be decreased around 10-30% in comparison to HFO or MDO(Marine diesel oil)(Ouyang, 2020), (Spoof-Tuomi & Niemi, 2020) & (“Study: LNG may offer 10%”, 2019), while its price is also cheaper than LSFO and VLSFO(Very Low Sulphur Fuel Oil) and in some area even less than HFO. However, the main purpose of using LNG is to meet the Sulphur emission control obligation, which is imposed by IMO. There were 172 vessels only before the beginning of 2020, which were burning LNG and this number was increased to 318 ships in 2020(“ Number of ships using LNG”, 2019) & (United Nations Conference On Trade And Development, 2020).

Challenges

Although each company may follow one of the above-mentioned solutions or adopt a hybrid approach, there are still serious problems, which must be addressed. For example, due to the short supply of LSFO, the bunkering companies, and refineries, blend the HFO with VLSFO in order to meet the standard sulfur content of less than 0.5%. However, this may violate other standards like the flashpoint, ash content, or stability and may have safety risks(Ouyang, 2020). On the other hand, using a scrubber may reduce the sulfur content of HFO, but as it uses either freshwater or seawater and discharges that water to the sea after completion of each operation, then it contaminates the seawater.

If the shipowners decide to adopt the third approach and use LNG as fuel, they may face more challenges too. First of all, they have to convert the ship and the converting costs could be around USD 25-30 Million plus keeping the vessel in drydock around 3-4 months as well(“Converting LNG ready box ship”, 2019) & (“LNG boxship conversion still”, 2020). Furthermore, the building cost is also too high in comparison to the building cost of a normal ship, which burns fuel oil. For instance, the price of a 20000 TEU(Twenty-foot Equivalent Unit) container ship, which burns LNG, would be approximately USD 160 million, and the price of a 22000 TEU container ship, which burns fuel oil is USD 140 million at the same time, as stated by CMA CGM(“Jacques Saade-class container ship”, n.d.) & (Ouyang, 2020). Moreover, the fuel tank of such a vessel is bigger than the normal fuel tank, which means that there will be less space to load the cargo, and last but not least is about the port

facilities and bunkering facilities for LNG. Although due to the trend of using LNG powered ships, many ports around the world incorporated the facility to refuel the ships with LNG, like Barcelona, Hammerfest, Montreal, Panama, Dominican Republic, Kochi and Yokohama, and some other ports in Germany or Gibraltar or France are planning to develop the required structures for that, however, only Singapore, Rotterdam and Zhoushan port are currently equipped with ideal facilities for LNG bunkering("LNG bunkering facilities", 2020).

Furthermore, by using operational measures like slow steaming, the shipping companies may be able to reduce the emissions in the short term, but they will encounter some challenges at the same time, like late arrival to the load or discharge port or optimum speed design. Also, the main challenge of imposing tax or incentivization will cause to generate more emissions up to the maximum possible level, which has been determined by the governments by making a price for the emissions.

Gaps in previous research projects

However, despite some initiatives like Poseidon principles, which give loans and financing to those shipowners only, who have prioritized and implemented sustainability strategies or BAF(Bunker Adjustment Factor), which is putting the extra cost of the bunker on the shipper´s or charterer´s shoulders, increasing operating costs is becoming a critical challenge mainly to the shipowners. Furthermore, the new studies doubt LNG (liquified natural gas) fuel's life-cycle GHG emissions benefit, but it is not proven as yet and it needs more research on this topic and there are pros and cons for that (Pavlenko et al., 2020). For instance, according to one research regarding the replacing of fuel oil with liquified natural gas, it is concluded that using LNG is not able to meet the International Marine Organization's GHG strategy and it could even bring negative climate impact. It may decrease the CO2 emission, but it emits Methane, which is even worse than CO2 in long term. In addition, more investment in LNG infrastructure on vessels and port sides will make it more complicated to transition to low-carbon and zero-carbon fuels in the future(Pavlenko et al., 2020). At the same time, there are a lot of concerns from stakeholders regarding the new regulations and their negative impacts on the business side and their profit on a global scale.

This study is going to figure out these claims and how the maritime sector can implement a competitive strategy to be more sustainable rather than

replacement of fossil fuel by LNG or biofuels or other similar solutions and whether the new legislations put the shipping industry at risk and how globalization is affecting this legislation and whether the main stakeholders can change their view and see sustainability as the opportunity rather than a necessity or not.

Role of sustainability in the maritime industry

In general, sustainability encompasses three main pillars of economical, environmental, and social, which have been applied to many sectors, including the maritime industry. Out of the three, the environmental aspect is broadly discussed in the literature, mainly focused on the vessels and port facilities(Tae-Woo Lee, Kyoung Kwon, Ruan, 2019). The social dimension in the maritime sector has been focusing more on the people and the crew and their family members, who are living in the ports worldwide and their life is endangered and influenced by the vessels' emissions and other pollutants from port activities, which may lead to infectious disease. In addition, discrimination between the crew members, cultural diversity, safety, and security issues on board of the vessels, and similar related problems are other key factors of the social side in the maritime industry.

Furthermore, the economic dimension of sustainability in the maritime industry is inseparable from two other dimensions. For example, being competitive in the market by decreasing the cost of transport and investing in the new green technologies at the same time to meet the regulators and charterers' requirements, which impose additional economic pressures to the shipping industry, is one of the main challenges of economic dimension, which has to be addressed by the shipping industry.

Moreover, a lot of attempts and research projects have been done to academically clarify or empirically discover and examine how globalization affects sustainability in terms of environmental, social, and economical. However, all of these efforts could not lead to a consensus yet to clarify the possible impacts(Bilgili et al., 2019).

Key theories

Globalization is expected to help to diminish environmental degradation, economic disruption, and also social problems through the technologies,

collaboration, and interdependence between the countries. On the other hand, this strong belief may move backward and become reversed like the current situation. This is very important to find out to what extent globalization contributes to sustainability and where improvements are mandatory.

Since the last decades, there have been abundant concerns about the negative influence of the sea logistic on the environment and ecosystem, which caused the academic communities, experts, and the main stakeholders of the maritime industry to look into that as a critical topic, which required extra efforts and time(Koilo, 2019). Despite continuous endeavors and smart initiatives in the reduction of the negative effects of sea transportation, the condition of the marine environment and aquatic ecosystem continues to worsen. That's why it is essential that the primary stakeholders of the maritime industry like regulatory agencies, shipowners, port state, flag state, classification societies on one side and the scholarly world, private and public sectors, business communities, and the financial sector on the other side, as well as the governments, collaborate and cooperate in order to find out the best practical ways (Koilo, 2019).

However, paying specific attention to emissions does not mean that there are no other environmental concerns in the sea. There are some other key issues at sea, including but not limited to vessel collisions, oil pollution, and water pollution, which need to be taken into account by the experts. For example, according to the reports about the European flagged ships, which were in operations within the European territory in 2016, there were approximately 3300 accidents in the sea, which involved 3669 ships in that period only. 36 vessels out of 3669 were lost with 115 casualties in total. 62 % of these failures have happened due to human fault and 278 accidents caused water pollution because of the release of the vessel´s bunker and other residual oils(Monios & Jiang, 2020).

Now the main objectives of stakeholders and in the general maritime sector are addressing the issues in a feasible way and finding the best solutions for the short and long term, enabling them to overcome the obstacles. Besides, the Shipping sector and especially the shipyards, ship owners, and port authorities are trying to apply sustainability concepts into the industry, and IMO as the main ruler of the shipping industry is enforcing all main stakeholders to achieve such developments. Furthermore, the main stakeholders have been trying to take the necessary actions in order to meet these requirements and reach their financial goals at the same time.

Nevertheless, there would be a wide range of challenges and additional costs, which have to be covered to attain these objectives. In addition, the stakeholders have a broad range of objectives and interests from environmental to social and economical aspects, which conflict with each other. For instance, a vessel that is registered under the flag of Liberia and has Greek owners carrying out cargoes between Persian Gulf ports and her crew are from Georgia and Russia, while she is under the management of a Russian company, has already involved different stakeholders with different goals.

Also on the port side, whereas the main stakeholders of the maritime industry, who are the key drivers of sustainability strategies including IMO, Shipyards, Shipowners, Port States Control, Flag states, regulatory agencies, and nation-states, there is a conflict of interest among these players in five major areas as follows:

- Environmental protection
- Urban development
- Labor
- Resident interests
- Economical development and profitability (Galvao, Wang, Mileski, 2016).

That’s why it’s not easy to integrate these key players and areas as a coherent group and implement a proper strategy across the maritime industry. Furthermore, the current governance model is not able to meet the current needs in terms of environmental, social, and economic development within the maritime sector and acquiring an applied and beneficial answer to these problems and conflicts caused by intricate governance subjects and varied main players, who have interdependence to each other, has been one of the main subjects of marine environmental governance in different countries (Jiang, Chen, McNeil, Dai, 2019).

From the stakeholder theory perspective, the organizations and companies should be administered in a way that, in addition to strive to increase the shareholder´s profit, make the most effective use of wealth and value creation for all of their stakeholders as well. Based on this point of view, it has been covering sustainability in terms of environmental and other aspects of a sustainable business like corporate social responsibility(Venkataraman, 2019). However, the second part is very often overlooked and it is limited to generate financial profit for one or two groups of stakeholders

only(Schaltegger, Hörisch & Freeman, 2017). So at this point, a couple of questions come to mind.

> For example how the International Maritime Organization expects that Africa fulfills its obligations in terms of sulfur emission control, while there is no appropriate infrastructure in most African ports at all and many people do not have access to clean drinking water?
>
> Or how the IMO is going to achieve its goals in terms of reduction of GHG emissions, while in many countries or areas, there are different priorities rather than sustainability?

The industry could be named sustainable, when it implements and maintains a successful strategy to deliver economical, social, and environmental advantages altogether(Venkataraman, 2019). Hence, this study investigates how to improve the conflict of interest between the Primary stakeholders in the maritime industry by adopting feasible strategies and making a consensus to meet their needs and goals.

Last but not least is the role of global challenges like the decline in oil price, Brexit, or Corona pandemic and their consequences in the maritime sector especially in terms of sustainability. Like any other challenges, global challenges have also negative consequences for some stakeholders and some opportunities for others simultaneously. For example, during the financial crisis in 2008 - 2009, there was a huge loss for global shipping including the drastic negative change in the freight rates, empty ports, idle vessels without cargoes, workers layoff and vessels layoff, financial losses, and bankruptcy, which had a domino effect on the whole industry and many countries, while China ports could catch up its external rivals in terms of developing its terminals at different ports and implementing more infrastructure in order to increase its capacity(Kalgora & Christian, 2016).

According to the Review of Maritime Transport 2020, which is issued by the United Nations Conference on Trade and Development, global shipping trade will be decreased up to 4.1% until the end of 2020 due to the Corona pandemic. Moreover, it is mentioned that it might be even worse because of new waves. However, it can return to the growth rate of 4.8% by 2021 subject to the implementation of a cohesive strategy for a transformed post-Corona pandemic world(United Nations Conference On Trade And Development, 2020). In addition, there are still some other challenges like crew change

issues due to the travel restrictions or maintenance of inland operations because of closing the borders, which brought negative impact for cargo transportation towards the ports or vice versa, which need to be addressed in a practical way and it is essential to increase the cooperation and collaboration among the primary stakeholders of the shipping industry in both national and international level and improvement of transparency and exchanges of the data between the all concerned parties as well.

Summary

To summarize this section, it must be declared, that based on the current scientific knowledge, existing methods and initiatives, the maritime sector is not able to help the sustainability issue in a perceptible way and more studies, more collaboration, and better solutions and strategies are required to impact the industry in an appropriate way in the long term to fill the gaps and address the main issues, enabling it to meet the sustainable development goals and maintain them as well. None of the existing solutions are practical enough to cause phenomenal effects on the environment or address the stakeholder's economical or social concerns. Hence, the key stakeholders of the industry should think outside of the box and consider different approaches by using the new technologies, exchanging the information and implement more solid strategies and set realistic objectives rather than idealistic ones in order to achieve them successfully and think about how to maintain their positions after the achievement of each level and filling the gaps, not only in terms of economical but also environmental and social, and also keep sustaining the industry for the investors particularly during the current period of the market recession of the oil price and Corona Pandemic.

Furthermore and before ending this part, it is important to emphasize, that although the sustainability in the shipping industry in literature is discussed and fostered a lot from different perspectives, and practitioners have been trying to feel the gaps and address the issues by recommending different methods and tools, the reviewed literature shows that the industry is still suffering from the absence of cohesive frameworks, which can tackle the different challenges in terms of economical, social and environmental. The solutions in the literature may address a challenge, while they make another challenge for the industry or the idealistic goals, which have been set by the people, who do not have any accountability or expertise in economics or engineering and will cause to ask how can the shipping industry implement a competitive sustainability strategy. This paper is going to provide a better

understanding and in-depth insight into the main concerns of the key players of the industry and find out how the different stakeholders look into the challenges and analyze the answers in order to find out a better picture about the current situation of the maritime sector and answer the question.

3. Methods

The main purpose of this section is to describe the methodology approach, which is implemented to research the sustainability in the sea logistic and opportunities and challenges in the maritime industry as well as justification of using that specific approach, followed by research design too. In addition, it will also state in detail the sampling method and illustrate how the data have been collected plus analyzing the results. And finally, the validity of the data along with the limitations will be explored as well as ethical consideration.
The main objective of carrying out this research paper is highlighting the gaps in the maritime industry in terms of environmental, social, and economical and trying to find the main obstacles and challenges and some bright answers for those issues.

The main question of this research was

- How can the shipping industry implement a competitive sustainability strategy?
-

In addition, there are also 1 sub-question too, which was as follows:

- What are the main challenges and how to see these challenges as an opportunity?

Sustainability science is a prominent topic of research projects, which is discussing the reciprocal influence of social and natural systems on each other and evaluates how and to what extent those interactions have an impact on sustainability(Kates, 2011). The qualitative approach is very often used in social science and human behaviors, as well as their experiences and opinions, which are tough to acquire by quantitative techniques like processing of numerical information or utilization of mathematics(Guest, Namey & Mitchel, 2013). Besides, it generally deals with those groups of research questions, which are going to find out the what, when, and how of phenomena in order to explain and figure it out instead of keep recording the frequency of that(Basias & Pollalis, 2018). In addition, it is commonly used to

respond to the questions from the participants' perspectives, their inner experiences, and to research their opinion in depth(Hammerberg, Kirkman & De lacey, 2016). Furthermore, this approach may lead to a more holistic understanding of the people and participants experiments in particular contexts and environments and will make it easier to figure out various human´s objectives and their voices as well as its flexible structure, like designing the semi or unstructured interview, which enables the participants to have a sense a freedom and expose their real meanings and ideas(Rahman, 2016). Also as the researcher is obliged to extract the real meaning of the information and come to the result by him/herself based on his/her mindset and experience, the outcome might be more natural, however, the researcher should always be alerted to avoid potential subjectivity(Basias & Pollalis, 2018). Moreover, the technology phenomena and business concepts and challenges have been investigated and assessed frequently via a qualitative research approach, as it is essential to implement an in-depth survey in order to acquire a profound perception(Baskerville, Cavallari, Hjort-Madsen & Pries-Heje, 2010). Although the credibility of qualitative research approach is mostly impeached by the academic communities, who are adopting the quantitative approach, mainly because of using two different criteria for accuracy and authenticity, however, there are different frameworks for the assessment of qualitative approach in order to make sure whether the research study, which used qualitative approach is trustworthy and authentic like Guba and Lincoln´s framework(Kalu & Bwalya, 2017).

To summarize this part, the strong point of the qualitative research approach is its usefulness in the investigation of intricate concepts, which are too complicated to assess quantitatively and there is a need to explore a phenomenon, which needs to be addressed by encouraging the participants to share their real point of view and voices, however, the researcher should be always conscious to keep bias from happening and strive to be away from subjectivity. That's why this study used a qualitative research method and to collect the required information regarding the existing challenges of the maritime industry and the potential solutions, and due to the time restraint, an online semi-structured interview was conducted and a sample population was chosen, who represented all of the key stakeholders of the shipping industry. For this matter, 19 people have been chosen within the industry as listed below in order to evaluate the problems and solutions from different perspectives:

- Panama & Liberia Flag state inspector in India
- Executive board member at Turkter Shipyard in Turkey

- Ship Manager at CMA CGM in France
- Port state control inspector at maritime transport of Georgia
- Shipowner at SPI Marine UK in England
- Sustainability manager in Essberger tankers in Germany
- Marine surveyor at Indian Ship Registry in India
- Director of Marine North-east Europe in RINA in Italy
- Senior director corporate communications at Hapag-Lloyd AG in Germany
- Country chief executive at Bureau Veritas group in China
- Chartering Manager at Mena Energy DMCC in the United Arab Emirates
- Chairman at Institute of chartered shipbrokers (Hong Kong Branch)
- Chartering manager in Leon Shipping S/A (Greece)
- Commercial(Chartering) ship operations in Rensmarine (Netherlands)
- Managing director of Eastgate Shipping Ltd (United Arab Emirates)
- Associate at Watson Farley & Williams LLP as Marine Legal Institution in the Middle East (United Arab Emirates)
- Chartering Manager at Phuong Nam Investment tourism and shipping Co. (Vietnam)
- Vice President of Communication in Kongsberg Maritime (Norway)

Such an implemented approach allowed this research to deliberate and contrast the primary stakeholder´s experiences and their point of view in terms of current sustainability issues and gaps in the global shipping industry and existing policies and legislation as well as future challenges and opportunities. In addition, the findings and potential solutions, which have been recommended by the in the interviews, may lead to adopting some new strategies in the industry. Figures 1 and 2 show the maritime industry stakeholders, their interdependence with each other, and how they are interrelated and interact with each other.

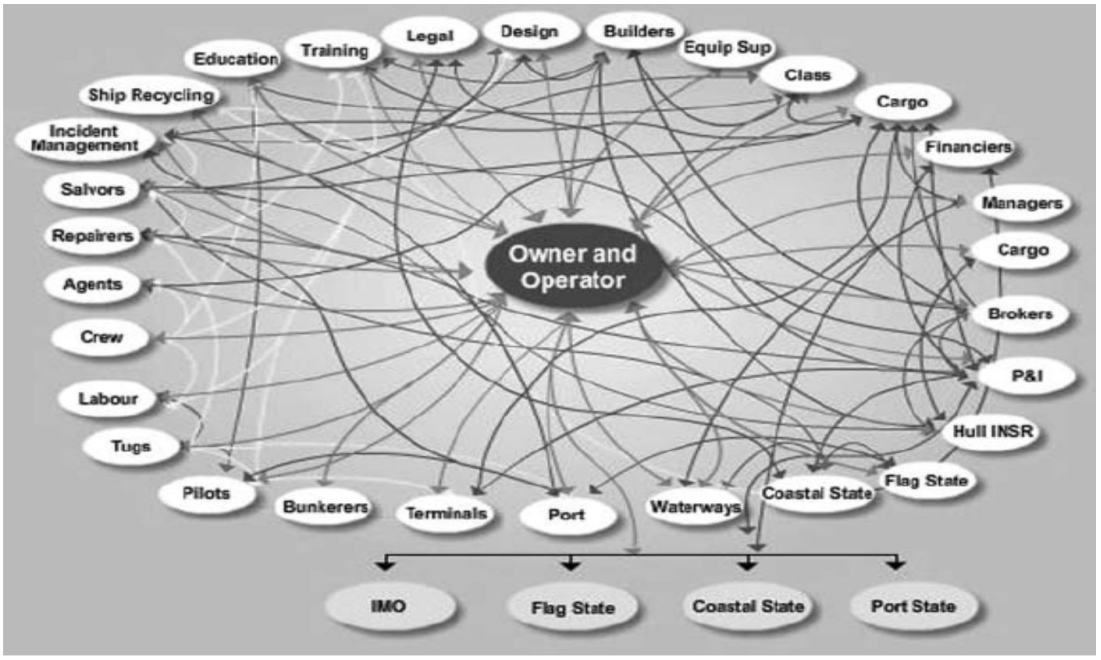

Figure 1. Adopted from “Information Environment, Fatigue, and Culture in the Maritime Domain,” by M. Lutzhuft and M.R. Grech and T. Porahe, 2011, Journal of Reviews of Human Factors and Ergonomics, 7(1), p. 283. Copyright 2011 by Maritime Industry Foundation. Reprinted with permission.

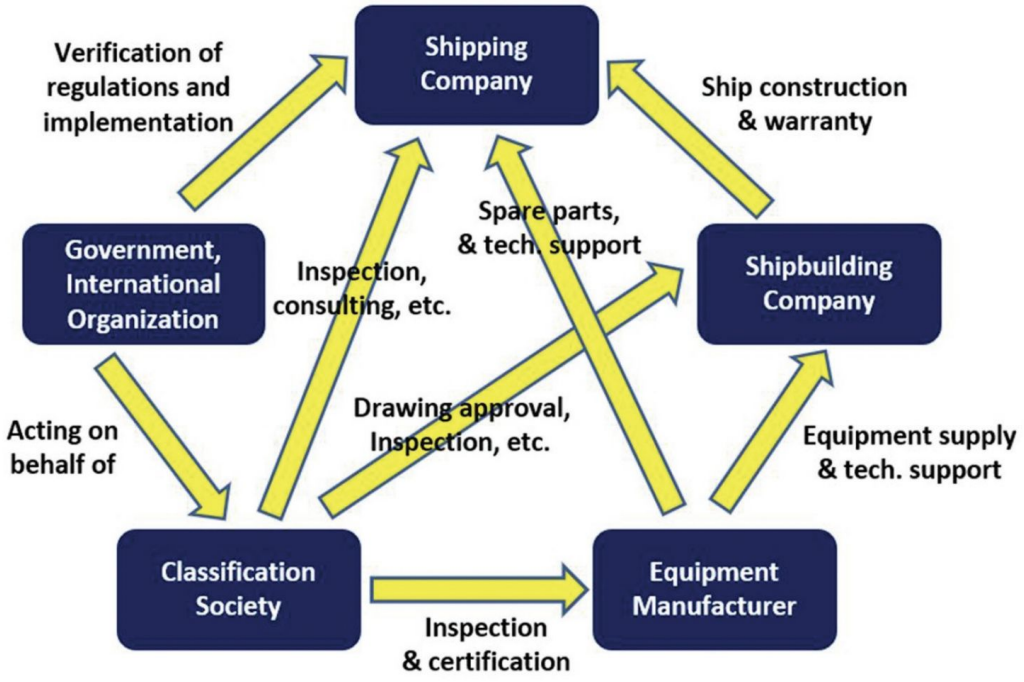

Figure 2. Adopted from “Autonomous shipping and its impact on regulations, technologies, and industries,” by M. Kim and T-H. Joung and B. Jeong and

H-S. Park, 2020, Journal of International Maritime Safety, Environmental Affairs, and Shipping, 4(2), p. 22. Copyright 2020 by Taylor and Francis Group. Adapted with permission.

Research design

This study has followed a phenomenological approach. To justify the implementation of this approach, the following points are required to be mentioned:

Phenomenological research is a common qualitative research approach, which mainly focuses on the sharing of human experiences within a specific group of people. The main objective of this approach is to clarify the phenomena through the description of meanings, experiments, and incidents, which have been observed and understood by that specific group(Creswell, 2013). Phenomenology, which is called non-positivism too, is one of the branches of interpretivism, which states that what is directly understood and experienced in communication is more authentic and trustworthy than anything, which will be obtained via interpretation or indirect explanation(Remenyi, Williams, Money & Swartz, 2013).

Basically in this approach, the researcher interviews a group of people, who have unprecedented and novel information about an incident or experiment. In addition, the interviewer asks two broad questions: Practical contact with the concept and the observation of the event as well as circumstances and estates, which affect that phenomenon(Creswell, 2013). Furthermore, and in terms of its epistemology, the pattern of personal experience and subjectivity, as well as the importance of personal vision and meaning, are the foundation of the phenomenological research approach(Lester, 1999). As sustainability in the maritime industry is an exceptional topic with different groups of stakeholders, who have their own visions, experiences, and interests, and to develop a distinct meaning and a fresh understanding of the global shipping challenges in terms of economical, social, and environmental, which are stemming from various reasons, the phenomenological approach was used for this paper. Although this approach may have some limitations like difficulties in assessment and explanations of the data, or hardness in the adjustment of the steps and development of the research as well as lack of reliability from the legislator's point of views and subjectivity and bias, it has its own strengths too. Observation of the changing flow during a period of time, simplification of methods to perceive the participant´s objectives easier as well as supporting to frame the new challenges and obstacles and also generating new theories can be named as the advantage of this approach(Easterby-Smith, Thorpe & Jackson, 2008).

Sampling method

The sampling method, which was employed in this research paper is Purposive sampling, which is a type of non-probability sampling technique. The academic communities may call this method selective, subjective, or judgmental sampling too and in simple words, it is a specific method, which relies on the purposeful selection of participants, who have relevant experiences, knowledge, expertise, and relationship to that study(Etikan, 2016). Unlike other sampling methods, this technique, which is a nonrandom method, does not need a certain amount of participants or specific theories. The main purpose of this method is to answer the research question by the deliberate choice of the group of participants, who are able to answer the questions because of their knowledge or expertise(Sharma, 2017).

It is a favorite approach in qualitative research methods, which helps to collect the intended information through the most appropriate available sources. Having a broad range of techniques, being cost-efficient, timesaver, and perfect for exploratory research design are the advantages of this method(Taherdoost, 2016).

In order to obtain further understanding of sustainability in the maritime industry and the potential challenges and opportunities, semi-structured interviews have been carried out with the primary stakeholders of the maritime industry. The shipping industry includes shipowners, ship managers, charterers, ship agents, brokers, marine legal institutions, flag states, port states, classification societies, and regulatory agencies as the primary stakeholders of the sector. Because of that, the sample group had to be selected from each community, while the participant had to have good enough experience in the maritime sector. In addition, the recent research projects in the shipping industry have been overlooking the small companies or stakeholders, who are not well known in the maritime sector, while they are playing an important role in the implementation of any strategy within the maritime sector. Therefore the interviews were conducted not only with the well-known companies and groups but also with the unknown or small companies in order to gain in-depth insight from different perspectives in the different conditions. As the researcher has been working in the shipping industry in the field of sea logistics since 11 years ago, he has a good relationship with the different concerned parties. However the approach method to some of the well-known companies like CMA CGM or Hapag - Lloyd or Flag state has been done via Linkedin and in order to get better feedback, the Linkedin profile has been upgraded to the premium version too.

All of the 19 interviews except one case have been conducted virtually by using the Google meet, Microsoft Teams, or Skype platform depending on the participant´s requests and their preferences through video call, and that specific case was conducted via telephone. Furthermore, all of the interviews

lasted roughly 50-55 minutes. Of course in some cases like interviewing with the flag state, it took around 2 hours too. The role of the researcher was an active role by asking the questions and also explaining some points or changing or adding some questions depending on the participant´s answers, however, the researcher tried to be objective during all of the interviews and did not share any belief or sight to the participants (The interview questions can be found in appendix A).

In addition, all of the participants have been informed about recording the interviews, and all of them agreed to mention their name if necessary and using their statements in the thesis and separate consent forms have been already sent to all to get their written confirmation as well.

Data Collection

In addition to conducting the semi-structured interviews, all of the participants furnished with the draft of the questions 2-3 in advance, enabling them to have enough time to think about them and also investigate as well if necessary and all of the interviews have been carried out from 27th of November till 24th of December 2020. Furthermore, a recorder application was used to record the interviewee's voice, enabling the researcher to transcribe them later, while he was focused on the participant's responses and also their body language as well.

Data Analysis

Data Analysis is one the most important parts of a research paper and it is required to put more attention on this part, as by choosing a wrong approach, the outcome might not be precise and beneficial. Data analysis in qualitative research method is about making the data ready to be examined in detail and then refining classifying them into the concepts via coding and categorizing process and identifying the patterns or relationships and then as the final step, demonstrate them as discussion, charts or tables(Creswell, 2013). The main distinction of qualitative data analysis with quantitative one is working on texts rather than numbers and the researchers are mainly working on the texts, which can be either an interview or their observation or even an image(Schutt, 2009). The most specific approaches of qualitative data analysis are content analysis, discourse analysis, Narrative analysis, Grounded theory, and Interpretive phenomenological, which is known as framework analysis or thematic analysis too(Bhatia, 2018), (Warren, 2020) & ("Qualitative data analysis", n.d. para 1). To give an overview of each, Content analysis is mainly used to assess the concepts by analyzing the documents, or behaviors, which can be either words or images. Discourse analysis is evaluating meanings and languages within their social contexts. The narrative analysis evaluates the stories, which are collected by the researcher in order to find out the real meanings of the participants and answer the research question. The grounded theory begins with analyzing a single sample or small

group of people within the different contexts to generate a pattern or hypothesis. However, during the analysis, the researchers may face new patterns and continue that in order to find out a pattern, which fits all. And finally, the thematic analysis, which includes different steps and will be applied to figure out mainly the experiences of the participants, their view and knowledge or meaning of an incident from the collected qualitative data, which might be related to those groups of participants in order to identify a pattern(Warren, 2020) & (Caulfield, 2020). However the most important weakness of the thematic approach is subjectivity and the researcher must consider this matter and avoid it as much as possible, while he/she interprets and analyzes the collected data. On the other hand, it provides important features and opens new gates, which will be helpful to carry out other analysis approaches(Delahunt & Maguire, 2017). Furthermore, it is not a methodology, but a method(Clarke & Braun, 2013), which means, it is not restricted to a specific epistemological or theoretical framework like other approaches, which makes this method very smooth.

There are various methods to implement thematic analysis, which might overlap the other qualitative analysis methods. Therefore this research paper followed the six-step process of Braun and Clarke in order to avoid any confusion and mistake, as it provides an explicit path and skeleton for implementation of the thematic analysis method(Delahunt & Maguire, 2017). Before introducing these 6 steps, another necessary action must be taken, which is using either the inductive approach or deductive one and also which theme is going to be used, a semantic or a latent approach?

As thematic analysis is used to find the themes, an inductive approach is used for explorative studies by using the data to make a theme and framework, while the deductive approach is used when the researcher knows what he is looking for(Mortensen, 2020). According to Clarke & Braun, the researchers might be trapped by using the interview questions as a theme. In that case, the data will be summarized only rather than being assessed(Clarke & Braun, 2013). In addition, there is a specific distinction between semantic and latent, as the latent approach stands on a different level rather than semantic. A semantic approach scrutinizes the content of the data only is not going to scrutiny anything else, except the participant´s statements and explanations, while in latent approach, the researcher will try to find out the real meanings of the participant´s words or the hypothesis, wish might be hidden in the words(Braun & Clarke, 2006).

Due to the aforesaid reasons, and once the transcription of the interviews was completed, a thematic analysis was executed. In addition and in order to avoid any potential subjectivity or bias, a semantic approach was used to analyze the explicit content of the data only rather than making any interpretation or assumption. Furthermore, a deductive approach was implemented to analyze the data, as the theoretical framework and existing

knowledge provided a solid idea about the themes, which were expected to be discovered throughout the data analysis.

As explained before this, this research paper used the six-step process, which has been designed by Braun and Clarke to conduct the thematic analysis.

The first step was getting familiar with the data. Before doing any other actions, the researcher prepared the transcript of the recorded voices by using appropriate computer software and then refined them in a proper way in order to make them ready for further analysis. Also, some notes have been made, and started to think about them to make a proper plan for the next phases.

The second step was the coding section. In this part, the researcher managed to structure the participant´s explanations(data) in a methodical way, which means he managed to code the data and chose those parts, which were interesting and related to the topic and removed the additional useless information, enabling him to explain the content. The main tool for this purpose was the research question and the sub-questions, which helped the researcher to code those parts of the data, which could address the research question in a meaningful way. Once this part was completed, the researcher achieved a set of meaningful points and ideas.

The third step was looking for themes and creating them. As mentioned before this, a theme is a model, which helps the researcher to identify the remarkable and interesting points of the data, which can be related to the research question. After gaining a set of codes and identification of the interesting patterns, the researcher began to come up with the themes by incorporation of the relevant codes. However, after the completion of this section, the researcher understood that some of the codes were not close enough to the topic or were ambiguous and because of that, those codes have been removed and the rest of the codes could contribute to generate meaningful themes and share an insightful vision for the next step.

The fourth step was reviewing the themes. In this part, the researcher started to double-check whether the generated themes are beneficial and precise enough to represent the data or not. To this, all generated themes have been re-evaluated again by contrasting them with the collected data(Interviews) to make sure that nothing is missing or how the themes could be improved and whether the data support the themes or not and this process has been done a couple of times, and some themes have been modified and edited as well.

The fifth step was naming the themes. Once the researcher did manage to gain the final version of the themes, he started to define each of them separately, which need to be mentioned exactly what is the real meaning of each theme as well as showing how they will support the comprehension of the data.

The last step will be the finding part, which will be discussed and explained in detail in the finding part section of this research paper separately.

The validity of the Data & limitations

In terms of the validity and quality of the data in the qualitative research approach, the main question is how the knowledge is generated. From Plato's point of view, there was a contrast between the Doxa and Epistem(Sousa, 2014). Doxa is the knowledge, which is unfounded and without scientific support, while Epistem is the knowledge that has credibility, stability, and clearly established together with scientific pieces of evidence. The qualitative research methodology is often blamed due to not having enough scientific accuracy along with inferior justification for the method, which is approached as well as the absence of transparency in the data analysis part, which results in the achievement of subjective views and biased opinions(Noble & Smith, 2015).

Validity, Reliability, and generalizability are the frameworks, which are mainly used in quantitative research projects in order to prove the quality of a research paper, however, the meaning of these concepts might be different in the qualitative research approach(Leung, 2015).

Qualitative research is valid when the tools, procedures, and data are in congruence with each other. Reliability means consistency between the procedures and results. However, in terms of generalizability, there are various debates, whether a qualitative research result could be generalized or not, as the qualitative research projects mainly study a topic or a subject within a limited group of people and the result might not be applicable to all(Leung, 2015).

Of course, different principles have been recommended to evaluate the qualitative research method, which is known as extrinsic and intrinsic(Sousa, 2014). Extrinsic refers to the principles, which have been brought from a quantitative research approach, while intrinsic refers to the principles and techniques, which are in the context of qualitative research itself. However, the second principle is preferable, as by using that, the credibility of qualitative research becomes more(Morrow, 2005). One proposal for this purpose, which has been formulated by Lincoln and Guba in 1985 is using the framework of trustworthiness of the method, coherence of results, transferability, and application of results(Sousa, 2014), which suggest implementing a set of techniques to lead towards them, and use different words like credibility instead of internal validation, transferability instead of external validation, dependability instead of reliability and confirmability instead of objectivity(Creswell, 2013).

As this research paper used a phenomenological approach, the main question is about the principles, which must be considered to make sure about the

quality of the collected data. Although there are different methods for this matter, however, one approach looks to be more appropriate(Creswell, 2013). In this approach, the data would be valid if it is good enough grounded and relied on sufficient evidence and whether the generated patterns are exactly originating from the collected data and using their common specifications and frame or not. To achieve the answer, the researcher must ask him/herself five questions:

- Did I have any impact on the content of the explained answers, which may lead to a different interpretation rather than the real one?
- Are the explanations transcribed precisely and do they have the same meaning as the verbal explanations?
- Are there any other interpretations rather than mine interpretations by analysis of the data?
- Am I able to generalize the analyzed data or are they relating to that specific content only?
- Am I reflexive throughout the research? (Creswell, 2013)

This research paper used the Lincoln and Guba approach, which is appropriate for the phenomenological research method.

In terms of credibility, the researcher used prolonged engagement with the sample group. As mentioned in the sampling method, the researcher has been working in the shipping industry since a couple of years ago and because of that, there is a strong mutual relationship between the researcher and some of the participants. In addition, due to the researcher´s background and work experiences, the other participants have been encouraged to speak more about their experiences and challenges, and because of this, most of the interviews took more around 50-55 minutes to be finished despite the preliminary agreement, which was supposed to take 35-40 minutes. Also before and after the completion of the interview, the researcher received some articles, which were related to the research question from some of the participants. However, in some cases, there was a feeling that some participants are not going to share some detail about their companies, especially about the implementation of the sustainability strategies and the explanations were a little bit diplomatic rather than realistic.

In addition, another important element for credibility is the reflexivity of the researcher, which can be defined as self-awareness and self-appraisal (Berger, 2013). The researcher did his utmost to minimize his influence on the interviews and questions and act as an observer only in order to avoid any misleading or bias on the research process and because of that, during the interviews, he was quite silently unless it was necessary to explain some abbreviations or concepts like SDG as sustainable development goals or similar matter.

In terms of transferability, it was hard to generalize the finding to the whole maritime industry. First of all the participants were 19 persons only and the data collection method was through a semi-structured interview. In addition, the participants were mostly from European and Asian countries and for example, there were no participants from Australia or Africa, or Canada, which can be mentioned as one of the limitations of this study. That is why some main concerns and challenges were missed, which could change the finding. Nevertheless, by providing the explanations and finding in detail, the transferability may be applicable to other research projects. For instance, it can be used to conduct another interview with more developed and in-depth questions and approach a larger number of participants.

In terms of dependability, there was a supervisor, who had access to the document after conducting the research, in order to audit and assess the study, enabling the researcher to rectify the issues and improve the quality of the research paper as well.

In terms of confirmability, this must be mentioned that every researcher has his/her own prejudice in favor or against different things and it is really hard to maintain objectivity in the research. To diminish the bias, the researcher designed the interview questions with the help and advice of the supervisor to avoid any potential bias during the interview and data collection process. Besides, the researcher's role during the interviews was an observer only, just to make sure that there will not be any effect on the answers and explanations.

In terms of the limitations, it must be mentioned that, although the qualitative research method has been frequently undervalued due to lack of accuracy and robustness(Leung, 2015), however, qualitative research method and thematic analysis(Interpretive phenomenological) provide a real smooth approach to figure out in detail the people's experiences and they can be adapted to many various areas(Tuffour, 2017).

However, the researcher faced four limitations in terms of the methodology and also from himself throughout the research, which must be mentioned as follows:

- The first limitation was the sample size. Although it has been mentioned throughout the last semester, that the minimum number for the qualitative research must be 10 according to the Geneva Business School qualitative research policy and for this research paper, a group of 19 participants has been chosen and the interviews have been conducted too, however as the research topic is really extensive and should be assessed and evaluate from different perspectives and angles, it is necessary for the future research project in the same field

to approach more people to develop the sample size to the larger scale to gain more insights into the topic.

- The second limitation was in terms of designing the interview questions. Once the data collection period was completed and the finding process started, the researcher understood that some questions could be added or asked in a different way. So if there would be any possibility to develop this research in the future, the questions must be revised in a different way in order to achieve a better resolution.

- The third limitation was the researcher bias. Although the researcher did his best to be far away from any prejudice in favor of any idea or vise versa, however, it may happen during the interpretation of the data. To address this challenge for future research, it would be better if more than 1 researcher working on the same topic to not only decrease the influence of the researcher on the project but also save time and cover more groups of participants.

- Last but not least, the lack of access to some key players of the maritime industry like those people, who are working in the International Maritime Organization or in governmental organizations in different countries, as it is required to have a higher level of relationship to approach these groups of people and also enough time to manage to make an appointment. For example, the researcher did manage to approach some of the IMO technical officers or IMO advisors, but their schedule was fully booked till the end of February and after that, they could set an appointment. Despite that, the research was conducted, as it could furnish an in-depth comprehension of the participant´s experiences, perspectives, and mindset, which might be beneficial for future research projects.

Ethical consideration

The ethical considerations are taken very seriously by the Geneva Business School and a specific framework has been designed for this purpose to make sure about compliance with ethical standards in research projects and this framework was adhered to during the research period completely especially in terms of plagiarism and also data collection. An Ethics review form has been shared among both researcher and his supervisor along with a consent form for participation in the research.

All of the participants have been informed about the research topic, research purpose, and data collection method, which was online method inn advance via personal messages over the Linkedin platform along with full explanations and upon receipt of the participant´s confirmations for attendance in the interview, separate events have been created via the Geneva Business School´s email ID in the google calendar platform and all of the participants received the questions in advance as per their request via Geneva Business School Email ID of the researcher. Also before the interview, the participants have been informed that their voice was recording to focus on the interview, and also all of them approved for using their explanations, their name, and their company name or organization in the research paper and a separate consent form has been sent to all of them to have their written approval for the records as well.

In addition, the researcher did not ask any personal questions, except the first question, which was in the introduction part and relevant to the interview and finally all of the data have been stored in the Geneva Business School google drive with the researcher´s ID in order to make sure that the data protection regulation is not violated.

4. Findings

The following section is going to focus on key themes, which have been gained by conducting the interviews and display the results, which have emerged by analyzing the data.

- **Current estate of the maritime industry**

When asked about the current status of the shipping industry, most of the participants except 4 respondents answered at first the question from an economic perspective only despite knowing that the research topic was about sustainability in the maritime industry, which means that they consider the economic aspect more important rather than environmental or social.

The current state of the maritime industry		
Economic	Environmental	Social
Shipowners Shipyards ⇨ Dissatisfaction Shipbrokers Container section in the boom Others: Cyclical industry/Satisfaction Optimism about 2021	Shipowners Ship Managers ⇨ Over-regulation Ship agent Others: Satisfied/On the right track All: Global shipping is a pioneer in efforts for sustainability	**Main Concerns** Crew safety People, who are living at the port People at risk at the global level

Diagram No.1/Finding

- **In terms of economic**

A different range of responses related to this question was collected. While some participants were satisfied with the economic conditions, others had dissatisfaction with that, which was dependent on their sector. To give a clear picture of that, on the logistic side, the shipowners, shipyards, and shipbrokers were not pleased with the current conditions for two main

reasons, which were the Covid-19 recession and also decline in the oil prices on one side and also IMO recent imposed regulations and the geopolitical tensions on the other side, which not only put additional costs on the shipowners but also led to the significant decline for ordering the new vessels. However, one interesting point, which was mentioned by the majority of the participants, was that the container section is booming significantly, while there is a depression in the tanker or dry bulk section. This has been confirmed by the CMA CGM ship manager in Marseille in France and according to his statement, the freight rate has been almost doubled for the containers due to the Covid pandemic.

On the port side and also other key stakeholders of the industry, like flag state or classification society, or Kongsberg maritime as one of the technology pioneer of the maritime sector, they did not show any sense of dissatisfaction, however, they described the maritime industry as a cyclical industry, which is the worldwide economy engine and despite the global crisis, which led to keeping the maritime sector from its highest position, but it will find its way and will become mature.

Moreover, another significant matter by the entire participants was their optimism about the year 2021 and they were expecting economic growth in global shipping, which will lead to new opportunities for all of the stakeholders and they believed that the maritime industry will come up again and become more stable.

- **In terms of environmental**

In this part, the participants have been divided into two different groups. While the first group of them(Shipowners, ship agent, and ship managers) complained about over-regulation in the industry, the second group(Port state, flag state, and classification society)believed that the shipping industry is on the right track in terms of the regulations and also implementing the new technology and also automation between the ports and ships and three of them(one participant from BV classification society and the other person from the Port state control in Georgia and last one from the Institute of chartered shipbroker member in Hongkong) asserted that the regulations came into the force even late and they should be even more strict. On the other hand, there was a common statement from all participants that they believed the maritime sector is one of the front runners among the different industries in terms of its efforts to be more sustainable and also reduce its carbon footprint. Another

interesting perspective, which has been indicated was about the major impact of the economy on the environment and without a good economy, there will not be good enough investment in sustainability to meet the environmental goals. As an example, the shipowner´s concern was the increase in the running costs due to the adaptation of the new regulations, while they do not receive any specific support.

- **In terms of Social**

Four participants placed emphasis on three main concerns on the social side. The first concern was about the safety of the crew especially during the current Covid-19 pandemic, which has been bringing many issues in terms of the crew change and due to the strict rules all over the world, the crew have been facing difficulties and had to stay on board for a long time and the second concern was related to the all of the people. While many vessels around the world had to wait to either discharge or load their cargo but the trucks were stopped on borders and the whole operation was stopped. And the last indicated concern was about the people, who are living next to the ports worldwide and their health conditions are at risk.

Next Steps	- Using technology - Alternative energy - Digitalization - Helix approach - Incentivization - More strict rules
Important challenges	- Lack of balance - Global challenge - The discrepancy between the regulatory agency and operational requirements
Role of new legislation	- Beneficial role - Positive effect - Financial concerns should be addressed
Obstacles to meet ISDG	- Lack of Infrastructure - Lack of collaboration between the nation-states - Conflict of interest and geopolitical tensions - lack of support - Medieval mindset - Different standards, different levels, different countries
Role of new technologies	Crucial role - Solving the problem or part of the problem? - Lack of infrastructure - Perfect for the Short term but beneficial for the long term too? - Return on Investment? - Keep it under control
Role of global crisis	Short term: Painful Long term: Necessary and constructive
Solutions to make consensus	- Training, Collaboration, and transparency - Financial supports and generating of economic advantages

Diagram No.2/Other Findings

- **The important steps of the maritime sector to address the sustainability issues**

In terms of the path forward and addressing the issues, there was no common answer from the participants, and a wide range of answers was collected

based on their own point of view and sector. However, there was a meaningful relationship between the answers. While the shipowners, the shipyards, the flag state inspector, and the port state control officers were focusing more on the technological side and put emphasis on zero-carbon policy by using alternative energy resources and developing the new types of fuel, or digitalization and route optimization by sharing the data between the ports worldwide, the legal institution, the port authorities and chairman of Institute of Chartered Shipbrokers recommended four different points:

1) Use a Helix approach and improve Interaction between the shipping industry, the academic communities, and the governments.
2) Incentives the maritime sector to invest in the new technologies
3) No extension on the deadline for the convention and regulations
4) Using the different solution for different problems(One size does not fit all)

- **The Important challenges, which are influencing these steps**

Although the recommended steps and path forward of the participants showed a great deal of variety, the indicated important challenges were identical.

- The first indicated challenge was a lack of balance in the maritime industry. While the big companies are trying to capture the market, which spoils the market, the entrance of the new players to the market, who do not have any experience and look for short term goals only, makes the industry unstable.

- Sustainability is a global issue and needs to be addressed globally, however, the European countries and the USA outsourced their CO2 emissions to China and some other developing countries, while they can produce it inside their own country.

- The discrepancy between the regulatory agency´s requirements and operational requirements. It happens whenever a new regulation comes into force and the shipowners and ship managers have to adapt their ships to the new standard by investing a lot, while they must be competitive in terms of the freight rate, which makes it so difficult.

- **Role of new legislations**

As none of the participants explained the role of legislation, this question has been asked to get a clear understanding of this important factor.
Surprisingly, all of the participants, even those shipowners, who did not have a great number of ships and their fleet was including 15-20 vessels or even less, who were not satisfied with the regulations, admitted that the legislations are playing a beneficial role and have been bringing significant positive effects to the maritime industry and concerns have been conveyed and raised moderately and in overall, the new regulations are very constructive for the industry, for the vessels, for the trading, safety, and security of the ships and also will lead to more transparency. However, all of the participants had a concern about the financial part and they have firmly asserted that the funding must be considered.

- **Obstacles to meet ISDG**

Before describing the obstacles, it is important to mention that except for two shipowners and one board member of the shipyard, the rest of the participants were fully aware of sustainable development goals in detail.

- The main common barrier, which has been mentioned by all of the participants, was the lack of infrastructure in the ports and as an example, in terms of the protection of the planet and focusing on the maritime sector, one of the initiatives was using alternative fuel instead of fossil fuels and the most famous one is LNG. Although there is some doubt about using the LNG as an alternative fuel, it has been a trend and most of the big shipping companies have already started to use LNG powered ships like CMA CGM and according to their ship manager, they have already placed a new order for 5 more ships. However, the number of ports, which have an LNG facility for bunkering is so limited, except in Rotterdam, Singapore, and Zhoushan in China and just the European countries have begun to develop their LNG bunkering facility, which takes time.

- The second interesting point, which has been mentioned, was the lack of cooperation from the side of big countries. While the big countries like the USA, China, or Russia, are contributing a significant amount of

emissions, they are trying to outsmart the other countries in different ways. Real growth and real sustainability are not going to take place except on a global level.

- The third important obstacle was a conflict of interest at a global level and geopolitical tensions.

- The fourth issue was the lack of support from the government side to the industry in terms of financing or tax incentives.

- The fifth challenge was different initiatives from different parties, different NGOs, and IGOs with different goals and different policies instead of being united and setting a cohesive and consolidated roadmap

- The sixth indicated challenge was people's mindset.

- The seventh barrier was setting the different standards with different levels by the different countries, which makes it complicated to have a unique strategy.

- Also, underdeveloped countries have been giving their resources at a low price to develop their own countries, which makes the situation worsen in the long term.

- **Role of new technologies**

According to all participant´s responses, it became clear that technology is playing an important role in any industry and it leads to a good performance and is crucial to increase the efficiency and frequency, which facilitate to achieve the sustainable development goals and all of them put their emphasis on digitalization and automation in the maritime sector and saw them as the gamechanger. However, the participants indicated five interesting factors, which should be considered before implementation of technologies in the maritime industry:

- The first important question, which has to be addressed is: while technology and human beings are integrated and the technology is the

solution for almost every problem, it is part of the problem too, so how should it be used to stand away from the problems?

- The second indicated question was is the human being using the technology for sake of the technology or for solving the problems?

- How is the maritime industry expecting that all concerned parties implement the new technologies in their sectors, while there is no appropriate infrastructure in many parts of the world and governments do not support that?

- The fourth significant problem was using the new technologies, which address the problems in the short term only, while they generate a bigger problem in the long term and the necessity of studying the long term effects of the technologies

- The fifth question was the advantage of using technology and concerns about the return on investment

- Last but not least was keeping the technology under the control of human beings rather than giving control of everything to technology.

- **Role of global crisis**

In this section, the participants answered the question from two different perspectives of short term and long term.

- In terms of the short term, the common answer from all participants was that the global crisis is always painful for both industry and people, and from the economic aspect, it will reduce the investment in the shipping industry and from the social aspect, the people suffer and direct negative impact on the crew, who are on board of the ships and also people, who are living around the world. However, in terms of the environmental aspect, 1 participant indicated that the global crisis is beneficial to the environment, as it may reduce the volume of global trade and enforces industries to move slower like the Covid-19 pandemic.

- In terms of the long term, surprisingly all of the participants except one shipowner, who stated that the global crisis has a negative impact in

the long term, the rest had a more pragmatic approach and mentioned that the global crisis is always there and the type of crisis is changing only and the shipping industry as a flexible and adaptive industry knows how to deal with that, however, it is necessary to face the global crisis time by time and the industry needs disruption because, in their point of view, it is necessary and constructive and will disturb the ongoing depression and show that something went wrong, but the way of addressing the global crisis is very important.

    - It is required to change the policies, set different and smart strategies to fight with crisis and look at alternative options and have a global approach when facing a crisis

- The last important point, which has been indicated by all, was that the maritime industry will find its way in the long term but the people will suffer more.

- **Solutions to make consensus and address the problems**

In terms of the solutions, a broad range of answers was collected. Each participant had his/her own specific point of view to address the issues. However, the answers could be divided into two main categories.
The first category put emphasis on the training of the stakeholders and increasing the transparency and collaboration between the maritime industry and academic community by:

- Increasing the maritime standards and using more theoretical approaches by teaching the stakeholders
- Improvement of interaction between the maritime industry and the academic community by means of doing the research projects in line with the industry requirements and using a helix approach
- Thinking outside of the box and think global and act local and consider all aspects of sustainability and not economic aspects only
- Setting clear decisions and objectives and implementing them globally

The second category put emphasis more on economic aspects and the role of the governments and international organizations to boost the consensus between all stakeholders by:

- Supporting the small and medium-sized companies and discontinuation of imposing new legislation, while the last regulations are not fulfilled yet.

- Sharing the responsibilities to all stakeholders rather than shipowners and charterers only.

- Holding accountable the countries exactly at the same level of their contribution to the problems like GHG emissions.

- Increasing transparency by sharing the data and making things more measurable and building trust among all stakeholders by consideration of the benefit of all players.

- Reinforcement of collaboration between the international organizations and also governments both at the national and international level.

- Generating economic advantages for those groups of stakeholders, who are acting responsibly by taking some initiatives like carbon credit.

Having stated and analyzed the findings, the next chapter of this research paper will furnish detailed conclusions and interpret the main findings with regards to the research question and also literature review along with limitations and recommendations.

5. Conclusions, Limitations, and Recommendations

The aim of this research paper was to study the current state of the maritime industry and how it can implement a competitive strategy to become more sustainable and what are the main challenges and opportunities. This section is going to illustrate the main arguments and key findings and explain and evaluate them with regards to the objectives of this study and demonstrate how they relate to the previous literature review and other research projects, while it will evaluate its weaknesses and strengths, which will be ended with the recommendations.

Conclusion

The findings indicate that, while the economic aspect of the maritime industry takes priority over environmental and social, and the lack of financial support concerns a group of stakeholders, all of the key players take into account the fact that environmental and social aspects of the industry have to be considered more in the decisions and the maritime sector must balance all of these pillars simultaneously to achieve the SDG. Also, the research illustrates a correlation between the proper adaptation of both the new technologies and legislation in the shipping industry globally and the achievement of sustainability objectives, however, it is essential to provide appropriate infrastructure before using the technologies and enforcing the legislation, otherwise, it causes disappointment and dissatisfaction among the stakeholders. In addition, the results support the stakeholder theory, that without adaptation of a holistic approach and creation of value for all stakeholders and not a limited group of them, the industry will not be able to gain its goals in the long term. Furthermore, the analysis suggests that in addition to financial supports and creation of economic advantages, this is vital to building stronger collaboration not only between the maritime stakeholders but also between the developed and developing countries to boost the achievement of sustainable development goals at a global level and also support to enhance the transparency by sharing the data as well as training of the people.

The data of this research are in line with the hypothesis that globalization is expected to reduce environmental issues, economic disruptions, and social problems through technology, collaboration, and transparency and the shipping industry plays a key role in between as one of the main drivers of globalization, and the global crisis like Covid pandemic and geopolitical tensions may slow it in short term but it would be productive in long term, because the global crisis is necessary to shake up the industry and they will lead to a consensus, however, the globalization approach must be supported in different level by the key stakeholders to achieve the sustainable development goals.

Also, the results support the claim of doubt about the LNG fuel´s life-cycle GHG emissions benefit by Pavlenko. While it reduces the GHG emissions around 10-30% in the short term in terms of CO2 emissions (different studies show different results and the percentage varies from 10-30%), it might not be the final and permanent solution, which shows that the maritime stakeholders are aware of that and look into that as a temporary solution only, while they are looking for better alternatives.

While prior studies have focused more on the positive aspects of the different types of technology and indeed the technology is one of the main driver of sustainability, the data represent some sort of concerns in terms of the way of implementation of them and whether the technologies are getting used to solving the problems or they are getting used for sake of technology only and to generate money for a limited group of stakeholders. Also, the results provide a different vision into the relationship between the new technologies, legislation, and economic advantages. If there would be an economic reason and benefit, then stakeholders may adopt new technologies or seek alternative ways to meet the requirement voluntarily rather than being enforced by the regulations.

Also, the results fit with the previous research that lack of infrastructure is one of the main barriers to meet the IMO goals as well as sustainable development goals and the developed countries must increase their contribution to the developing and underdeveloped countries in terms of economic, technical support and transfer of knowledge, as everyone is living in the same planet.

Furthermore, the prior studies may provide insight, that the maritime industry may be over-regulated and it might be supported by the statement of some of the stakeholders like the shipowners and ship managers in this research paper too, however, the final results demonstrate that all of the stakeholders see the imposed regulations a useful way, which brings positive impact to the whole industry, however they are not deterrent enough unless all of the stakeholders on the international level can be held accountable.

Limitations

In terms of the limitations, the generalizability of the findings has to be mentioned as the first constraint, which was limited due to the restrictions on the sample size. Although nineteen participants have been interviewed within a period of one month, as sustainability is an extensive topic and the maritime industry is a broad industry with different groups of stakeholders, it is necessary to expand the sample group and conduct more interviews in order to extract more beneficial information and to make the result more generalizable. Nevertheless, the saturation of answers may compensate for this limitation and provide a moderate level of validity.

The second limitation was in terms of the interpretation of the data. The reliability of the collected data has been impacted by the researcher´s subjectivity and the researcher's bias and his experiences might have influenced the conclusion, which may not be the exact reflection of the participants. For instance, selecting the shipping companies and the stakeholders could be subjective and change the result of designing the questions based on the topic and the researcher´s point of view could be named as other elements of the subjectivity of this research paper, nonetheless the results are still valid to respond to the research questions, as the data has been collected from 19 different participants with different perspectives and experiences, which minimize the subjectivity and provide an appropriate level of objectivity.

The third significant limitation was lack of access to one of the main stakeholders of the maritime industry, which is the International Maritime Organization as the main regulatory agency for global shipping and due to the lack of data on the main reasons for some strategies and imposed measures, some critiques and results might not be confirmed. The researcher strived a lot directly and indirectly via different channels to make an appointment with any of the people, who are working as IMO members or IMO officers, in order to improve the validity of the data, however the earliest possible time was for February, however, as two of the participants used to work as a technical advisor to IMO in the past, they could see some aspects of the regulations and reflect them in the interviews.

Recommendations

This paper intended to study the current estate of sustainability in the maritime industry, challenges, and solutions. Based on the qualitative analysis of data, it can be derived that the maritime industry has been undergoing various challenges in terms of economic, environmental, and social, which can be addressed by using the technologies in an appropriate way, training the stakeholders, building trust and collaboration on both the international level as well as between the academic communities, maritime industry and states on the national level and financial supports. Also, the results demonstrate that the stakeholders are more eager to use the new technologies, comply with the regulations and adopt sustainability strategies when there would be enough support and incentives along with infrastructure accessible to all.

Returning to the challenges and findings, while it confirms the previous research and stakeholders theory and the significant role of globalization to achieve SDGs, it challenges the assumption of using LNG as the final solution to GHG emissions and confirms that using LNG can address the environmental challenges in terms of GHG emissions in the maritime industry

in the short term only and further research is required to specify its effects on the maritime sector.

Based on the findings, the stakeholders should consider the significant role of technology in the maritime sector and implement it in a feasible way in order to solve the problems and not create another problem in the long term. For example, by using the scrubbers, which is not very costly in comparison to LNG-Powered vessels, or using LSFO, the GHG emissions might be solved but the sea-life will be endangered. Or by using LNG instead of fossil fuel, which need a lot of investment in terms of building the appropriate vessels and also providing the required infrastructure at each port, which takes too much time, energy, and money, might reduce the GHG emission in short term, but it will generate Methane, which worsens the situation in long term. But the question is that is it possible if the vessels burn fewer fuels? The answer is yes if the practitioners think outside of the box. One solution is decreasing the resistance by decreasing the draft of the ships. For example, if the shipyards manage to build the bottom of the ships wider, then it leads to a lower resistance, which saves a huge amount of fuel in the long term and leads to lower emissions and saving money. Or what if the maritime industry uses nuclear-powered ships, which are powered by nuclear reactors and can be at sea for a long time without refueling.

Furthermore, by using the technology in a proper way, and building trust between the stakeholders, the achievement of the SDGs might be more achievable. Some shipping companies are currently using the slow steaming method rather than using alternative fuels or installing scrubbers, which decrease fuel consumption, which still creates some other challenges. However, by using technology, a global network can be implemented, that all of the ports worldwide connect to each other and share their data, enabling vessels to set their speed based on the load or discharge port information and set the arrival date somehow to be berthed upon arrival, which saves a lot of time, money and bunker. Of course, there are some challenges in between, which need to be addressed like lack of trust, geopolitical tensions, and lack of infrastructure. However, in terms of the infrastructure, the stakeholders in the developed countries can support this matter, as it is beneficial for all concerned parties either by investing at different ports in developing countries or providing financial support directly to those ports. Also if international organizations act stronger and make the members more accountable for their actions, such a network could be set up, which will lead to more transparency.

In addition, educating stakeholders play an important role in the maritime industry. Currently, there are a couple of international institutions that are a part of the maritime sector, for example, the International Shipping Federation(ISF), International Chamber of Shipping(ICS), and The Baltic and International Maritime Council(BIMCO) and they are interacting with each other. As an initiative, they can reset their goals and adopt a cohesive strategy in order to put their force in one direction rather than acting as

individual islands, who interact sometimes with each other. They can act as an intermediary between the maritime industry and the academic institutions and liaise with both sides to transfer the knowledge and challenges simultaneously.

However, further studies are required to establish more feasible and practical solutions and initiatives to address the main challenges in the maritime industry like the conflict of interest, alternative energies, digitalization, and automation, and also transparency. In addition, future research should take into account by researching more and approaching more people, who are part of the industry and plays an important role, like the IMO members, crew, and also the academic communities in order to get to know with other perspectives and collect more in-depth insights.

I would like to mention that this research allowed me to follow my field of interest and caused me to learn more not only about my field but also about some other concepts and topics. Furthermore, it helped improve some of my skills in terms of problem-solving and also challenging myself plus how to utilize online research tools. Moreover, the adoption of a scientific mindset will change your life. You will learn to challenge and doubt your assumptions and try to find out whether those assumptions are right or wrong, rather than believing everything easily and fast.

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Appendices

Appendix 1 - Interview questions

1) Please introduce yourself and describe your current work/responsibilities

- Name:

- Role:

- Shipowner
- Ship agent
- Port state control
- Flag state
- Class society
- Marine lawyer
- Regulatory agent

2) How long have you been active in this field?

3) Can you describe what you think is the current state of the shipping industry?

   Sub question - The below points have been mentioned when it was necessary to ask the participants about these specific points. Because as they knew about the topic, most of them explained in detail about the following points.

- Greenhouse gas emissions(CO_2, Black carbon, and ..)
- Oil pollution(Water pollution)
- Technology(Automation)
- Costs and investments
- Politics and regulations

4) What do you think should be the next steps or the path forward of the maritime sector?
   Sub question: (When the participants did not answer question number 4 in terms of sustainability, another question has been asked about the

topic along with some examples of challenges throughout the interview).

5) What do you think are the factors influencing these challenges and what can we do about them?

6) Do you think the new legislation and imposed measures are considering all of the primary stakeholder's concerns? If yes and/or no, why? (This question has been asked when the participants did not talk about legislation)

7) I would like to ask about integrated sustainable development goals and whether you know about these goals or not. (If the participant did not know about that, then I explained to him/her briefly about the SDG, and then the next question has been asked.

8) What are the main obstacles to consolidate a cohesive strategy to meet the ISDG? (To meet the integrated sustainable development goals)

9) How do you see the role of new technologies in between and will they facilitate the way of achievement to these goals or make it more complicated in both the short and long term?

10) How important is the role of global crises in this industry like the financial crisis or COVID-19?

11) As the last question, under what conditions you as a…….(stakeholder type), are ready to contribute to any investment to make changes in the current Maritime's circumstances, and what would be the best solutions to bring the key players of the shipping industry under an umbrella?