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**THE CONTRIBUTION OF SHIPPING TO
THE ACHIEVEMENT OF SUSTAINABLE
GOALS OF DEVELOPMENT**

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που υποβλήθηκε στο Τμήμα Ναυτιλιακών Σπουδών του Πανεπιστημίου Πειραιώς ως
μέρος των
απαιτήσεων για την απόκτηση του Μεταπτυχιακού Διπλώματος Ειδίκευσης στην
Ναυτιλιακή Διοικητική

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Abstract

Sustainable Development is a complex issue of global importance as it greatly affects the lives of all people. For this reason, the importance of sustainable development is understood for all its members and each of them individually and as a whole have taken a series of actions to ensure it. Sustainable development in any case is considered imperative. More specifically, it has three aspects: it contributes to environmental protection, economic development, and social justice. The shipping sector as a contributor to international trade is one of the main sectors of the world industry and contributes substantially to the achievement of the goals of sustainable development.

Regarding the methodology applied, it is a bibliographic search in international scientific databases such as Google Scholar, Scopus and ScienceDirect, focusing on scientific journals that study issues of sustainable development in the shipping sector. Also, relevant books are used, as well as updated material from the internet.

Keywords: Sustainable, self-sustaining development, goals, pillars, shipping.

Περίληψη

Η Βιώσιμη Ανάπτυξη είναι ένα σύνθετο ζήτημα παγκόσμιας σημασίας καθώς επηρεάζει σε μεγάλο βαθμό τις ζωές όλων των ανθρώπων. Για το λόγο αυτό, η σημασία της βιώσιμης ανάπτυξης είναι κατανοητή από όλα τα μέλη της και το καθένα ξεχωριστά και συνολικά έχει προβεί σε μια σειρά ενεργειών για τη διασφάλισή της. Η βιώσιμη ανάπτυξη σε κάθε περίπτωση θεωρείται επιβεβλημένη. Πιο συγκεκριμένα, έχει τρεις πτυχές: συμβάλλει στην προστασία του περιβάλλοντος, στην οικονομική ανάπτυξη και στην κοινωνική δικαιοσύνη. Ο ναυτιλιακός κλάδος ως συντελεστής του διεθνούς εμπορίου είναι ένας από τους κύριους τομείς της παγκόσμιας βιομηχανίας και συμβάλλει ουσιαστικά στην επίτευξη των στόχων της βιώσιμης ανάπτυξης.

Αναφορικά με τη μεθοδολογία που εφαρμόζεται, πρόκειται για βιβλιογραφική αναζήτηση σε διεθνείς επιστημονικές βάσεις δεδομένων όπως το Google Scholar, το Scopus και το ScienceDirect, με επίκεντρο επιστημονικά περιοδικά που μελετούν θέματα βιώσιμης ανάπτυξης στον κλάδο της ναυτιλίας. Επίσης, χρησιμοποιούνται σχετικά βιβλία, καθώς και ενημερωμένο υλικό από το διαδίκτυο.

Λέξεις κλειδιά: Βιώσιμη, αυτοσυντηρούμενη ανάπτυξη, στόχοι, πυλώνες, ναυτιλία

Introduction

The term Sustainable - Sustainable - Self-Sustaining Development (Sustainable Development) is driven by man trying to ensure a dignified survival on planet Earth. However, it is not a concept that exists only as a theory but follows a course that evolves through the improvement and management of natural and human systems. In particular, it is generally accepted that sustainability is a process based on three pillars, which are the environment, the economy and society, which interact with each other with the aim of satisfying the current needs of people, without compromising the interests of next generations.

Given that approximately 75% of the planet is covered by water, Sustainable Development relies on shipping and affects the marine environment. For this reason, over time several studies have been conducted to make the shipping industry as sustainable as possible and to contribute to the three pillars mentioned above (Ntona and Morgera, 2018, Recuero Virto, 2018). This is done through International Organizations, Conventions and Protocols.

Already in the 1980s, the scientific community had identified a number of environmental problems, which were distinguished into local, regional and global ones, while at the same time public opinion had begun to become aware of their mitigation. These exacerbated environmental problems were directly linked to the continuous increase in the earth's population, during the 20th century, which resulted in significantly greater pressures on natural resources, as well as to technological development, which was linked to the in turn with the intensity and extent of anthropogenic impacts (Cairns, 1991).

In more detail, the environmental problems identified during this period concerned the greenhouse effect, which is caused by the emissions of carbon dioxide due to the burning of oil, but also by the release of other gases into the atmosphere, such as the methane. Furthermore, there has been widespread destruction of tropical forests for logging, as well as for the development of agriculture, where these tropical forests could, through photosynthesis, significantly reduce atmospheric carbon dioxide

emissions. At the same time, the pollution and overexploitation of drinking water, underground and surface, was characteristic of this era, as well as the overexploitation of fish, the extinction of species, but also the destruction of the ozone layer (Kotrikla, 2015). Essentially, from the existence of these environmental problems, it was established that natural resources cannot be treated as free goods, that is, as goods which are unlimited and inexhaustible, as very soon the demand would exceed their supply (Carter, 2007).

Also, it was a common admission that some of the environmental problems existed at a regional level, such as acid rain, river pollution, etc., or the greenhouse effect, the destruction of the ozone layer, the extinction of species etc. and thus could not be solved through the implementation of piecemeal arrangements at the local level but required cooperation that would involve the regional or global scale. Thus, during the 1980s, the approach related to integrated environmental protection began to develop, where the interactions between environmental means were taken into account, while at the same time the interdependence of environmental policy with other forms of government intervention was recognized, such as it was for example agricultural, industrial and housing policy (Papadimitriou, 2003). At the same time, emphasis was placed on the prevention and not on the suppression of environmental degradation, in contrast to the prevailing mentality in the past, where the focus was on suppression (Grigoriou, Samiotis, Tsaltas, 1993).

This Thesis seeks to study in what ways shipping as an industry tries to adapt its operations towards the achievement of certain sustainable development goals (SDGs- Sustainable Development Goals), as they have been set by the United Nations Organization. In particular, the objectives concerning environmental protection, infrastructure and facilities are studied, as well as the objectives that promote gender equality in the shipping industry. The subject is approached by studying the actions and initiatives of public and private bodies, at international, European, and national level. The purpose is to identify and categorize them by objective and action category. Also, in the context of the analysis of this topic, the concept of sustainable development and its connection with the shipping industry is developed. Each chapter of the work deals with a different goal and with the actions that have been taken to achieve this goal in a national, regional, and international field of action, both at the

technical and technological level as well as at the level of initiatives and actions of various organizations. In conclusion, the gaps that exist in the issue under consideration in terms of the actions that have been designed and implemented are highlighted.

Regarding the methodology used, it is a bibliographic search in international scientific databases, such as Google Scholar and Scopus, focusing the research on scientific journals dealing with issues of sustainable shipping and sustainable development. Also, relevant scientific books are used, as well as material from the internet, emphasizing relevant studies with the subject under consideration, but also the extraction of corresponding statistics.

Initially, in this chapter, the characteristics of sustainable development will be described in detail and its historical development will be presented. Then, the objectives set for its defense will be recorded and reference will be made to the principles that govern it. In addition, the goals of sustainable development in shipping will be mentioned, the framework of the United Nations Organization and the International Maritime Organization will be presented, as well as reference will be made to the European Union and sustainable development initiatives. Then, the contribution of shipping to environmental protection through international conventions and regulations will be analyzed. Also, the contribution of shipping to economic development and social justice through the employment of seafarers will be presented. Finally, a brief overview of the work will be made, and the main conclusions will be presented.

The purpose of this paper is firstly, the recording and implementation of the goals of Sustainable - Sustainable - Self-Sustained Development and their connection with the shipping area and secondly the contribution of shipping to sustainable development. Of course, it should be noted that the following research question is examined: In what way and to what extent have the goals of sustainable development and the adoption of sustainable shipping been achieved?

Methodology

Regarding the methodology applied, it is a bibliographic search in international scientific databases such as Google Scholar, Scopus and ScienceDirect, focusing on scientific journals that study issues of sustainable development in the shipping sector. Also, relevant books are used, as well as updated material from the internet.

I used the following keywords: Shipping, Cheap and clean energy, Innovation & Infrastructure, Climate, Sustainable, self-sustaining development, goals, pillars, shipping.

Chapter 1. The concept of sustainable development

Sustainable Development or self-sustaining development is a key concept in the 21st century and a great challenge for all humanity. For this reason and in recent years, it has developed internationally into an important priority of governments, organizations, businesses, and civil society in general (Benamara et al., 2019, Yuen et al., 2018a). Everyone is invited to understand the complexity and interdependence of the issues raised, to contribute to the search for the right solutions and to commit to concrete actions both individual and collective. As for the definition of Sustainable Development, there is no absolute agreement. Its best-known definition belongs to the first prime minister of Norway, Gro Harlem Brundtland, who, as president of the World Commission on Environment and Development, delivered to the United Nations General Assembly in 1987, her report, entitled "Our Common Future", known as the "Brundtland report".¹ According to it, sustainable development is defined as: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs".² At the Rio International Conference, in 1992, the principles of Sustainable Development were first and officially formulated. There Sustainable Development is defined as: development that provides long-term economic, social, and environmental benefits while meeting the needs of present and future generations.

The treaties of Maastricht in 1992, Amsterdam in 1997 and the Johannesburg International Conference in 2002, ten years after Rio, confirmed the necessity of sustainability and established it both at the level of the European Union and internationally.

According to the European Union Strategy for Sustainable Development, as adopted for the first time at the Gothenburg European Council in 2001 and as developed in subsequent related texts: Sustainable Development is a continuous process of change and adaptation, and not a static state, with the aim of meeting the needs of the present, without compromising the ability of future generations to meet their own needs.

¹ <https://www.kemel.gr/articles/viosimi-anaptyxi>

² <http://www.un-documents.net/our-common-future.pdf>.

1.1. The pillars of sustainable development³

The balanced and equal pursuit of all three pillars of Sustainable Development: Economy - Environment - Society, aim at the well-being of generations (Cormier and Elliott, 2017, Recuero Virto, 2018). Through the combination, that is, of economic development, environmental protection, and social cohesion, as graphically illustrated in the diagram.

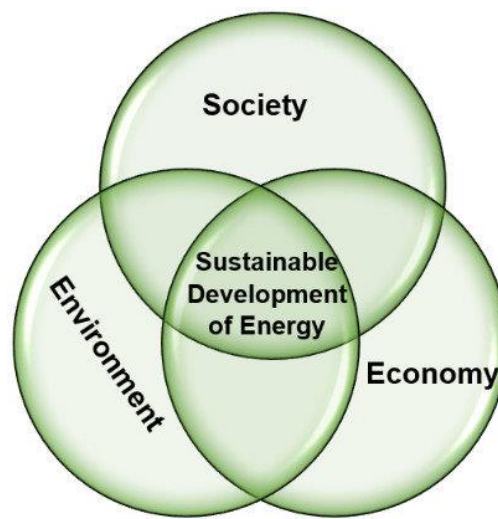


Image 1 Sustainable development and its three pillars

However, this combination of all three pillars of Sustainable Development is neither simple nor easy to achieve. For this they require:

- Combination of many actors at different levels, often between opposing interests and interests, also in function of the time factor.
- Correct, informed and constructive dialogue and consultation between the interested parties, which presupposes the creation of frameworks and the establishment of rules in which the interested parties can state their opinion.
- Coordinated actions with the participation and activation of all those involved: State, businesses, non-governmental organizations, and bodies representing civil society in general.

³ <https://www.kemel.gr/articles/viosimi-anaptyxi>

1.1.1. The 2 models of Sustainable development

The three pillars of sustainability are a powerful tool for defining the full sustainability problem. This includes at least the economic, social, and environmental pillars. If one pillar is weak then the system as a whole is not sustainable. There are two popular ways of depicting the three pillars (Sciberras and Silva, 2018).

Figure 2 shows the model of 3 overlapping circles. The overlapping circles model of sustainability recognizes the intersection of economic, environmental, and social factors. Depending on the dominant mindset, the circles are rearranged to show that one factor is more dominant than the other two. For example, some business leaders prefer to show the economy as the biggest circle because it is the most important to their success. They develop society as the second largest circle because customers and other important stakeholders live there. The environment will then be the smallest circle.⁴

Most national and international problem-solving efforts focus on a single pillar at a time. For example, the United Nations Environmental Program (UNEP), the United States Environmental Protection Agencies (US EPA) of many nations and Non-Governmental Organizations (Non-governmental organizations - NGOs) focus on the environmental pillar. The World Trade Organization (WTO) and the Organization for Economic Cooperation and Development (OECD) focus mainly on economic development, believing that it pays special attention to social sustainability, such as reducing war and the Justice. The United Nations attempts to strengthen all three pillars, but due to its consensual decision-making process and small budget it has little impact.

However, as the Great Recession of 2008 showed, the weakness of the other pillars can directly weaken the environmental pillar (Fleming et al., 2017, Sciberras and Silva, 2018). Many nations and states are scaling back or delaying stricter environmental laws or investment as their budgets run deficits. Many environmental NGOs are seeing their income decrease. If the Great Recession worsens significantly

⁴ <https://sustainabilityadvantage.com/2010/07/20/3-sustainability-models>

and turns into another Great Recession, one would expect the environmental pillar to receive much less attention, since consumption now takes priority over environmental protection. The social pillar is also very important. Once a war breaks out, environmental sustainability becomes zero priority (Islam and Shamsuddoha, 2018, Okafor-Yarwood, 2019). If a nation lives in great poverty, the environment is plundered without any thought for the future.

Therefore, solutions to the sustainability problem must include the sustainability of all three pillars.⁵

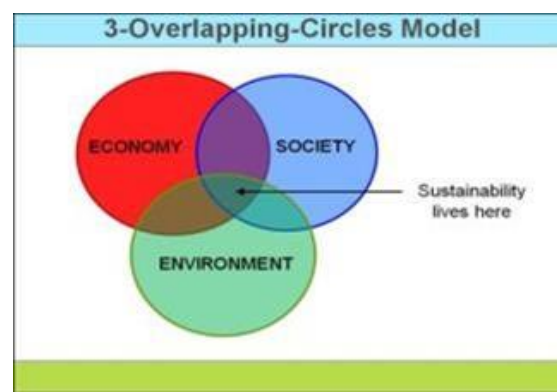


Image 2 The overlapping circles model shows the interaction between the 3 pillars. Source: <https://i0.wp.com/sustainabilityadvantage.com/wp-content/uploads/2010/07/Blog-07-20-10-Slide-3.jpg>

Figure 3 shows the 3-nested dependencies model which shows that human society is an entire subsidiary of the environment - that without food, clean water, clean air, fertile soil, and other natural resources the people of societies could not meet their basic needs in terms of livelihood resulting in the difficulty of survival.⁶

The three pillars of sustainability require systems thinking and view the world as a collection of interconnected systems. The largest system of all is the biosphere in which we live. It contains the human system, which has two main systems: social and economic. When groups of people, from a tribe to a nation, agree to form a government they form a social contract to increase their general welfare. This convention binds together the social and economic systems of the group of individuals

⁵ <http://www.thwink.org/sustain/glossary/ThreePillarsOfSustainability.htm>

⁶ <https://sustainabilityadvantage.com/2010/07/20/3-sustainability-models>

(Ntona and Morgera, 2018, Singh et al., 2018). People (the social subsystem) work together with a central government to maximize the output of their economic system. Viewing the overall system in this way makes it clear that environmental sustainability must be given the highest priority.⁷

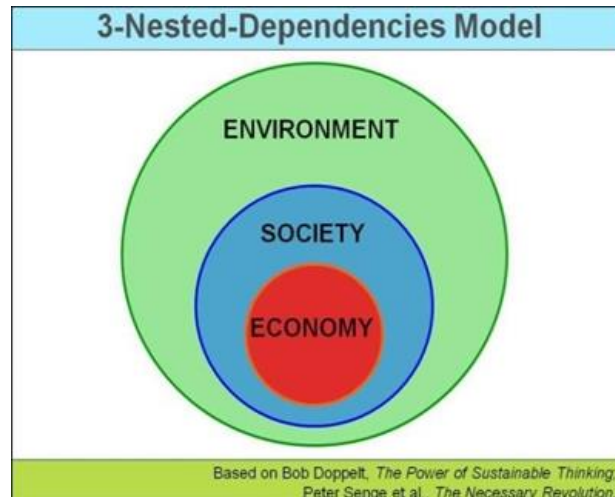


Image 3 The model of the 3-nested dependencies of the pillars. Source: <https://i2.wp.com/sustainabilityadvantage.com/wp-content/uploads/2010/07/Blog-07-20-10-Slide-4.jpg>

1.2. Important Milestones in History for Sustainable Development

The concept of Sustainable and Sustainable Development can be traced several years earlier when the need for development and progress was created. In the early development of these concepts, the spiritual evolution of man played an important role. For centuries, it has been recognized by both individuals and societies that development is necessary, primarily for livelihood reasons. Later, however, many theorists tried, as we have already mentioned, to define this concept, so that it can be a means of realization and application in people's daily lives.

As early as 1958, within the framework of what is now a global collective body, the United Nations, reference is made to the concept of sustainability, and specifically to the Convention on Fishing and Conservation of the Living Resources of the High Seas (Convention on Fishing and Conservation of the Living Resource of the High Seas). Later, in 1972, the United Nations Conference on the Human Environment was held again, where special emphasis was placed for the first time on the contribution of

⁷ <http://www.thwink.org/sustain/glossary/ThreePillarsOfSustainability.htm>

economic development, through which the environment could be protected. Since then, the need arose for the establishment of a new global body by the Organization itself, with a specific and specialized object to safeguard and encourage the cooperation of both states and citizens in environmental matters. Thus, UNEP was founded.

An important milestone in the history of Sustainable Development was the year 1983, when the World Commission on the Environment and Development (WCED) of the United Nations (UN) was created, which became known as the Commission Brundtland. The importance of this report lies in the fact that, on the one hand, it defined sustainable-sustainable development and on the other, it linked, on a scientific basis, environmental protection with economic prosperity and social progress, integrating the concept of environmental protection into development strategies.

Subsequently, in 1992, the 2nd World Conference on Environment and Development (United Nations Conference on Environment and Development - UNCED) of the U.N. was held in Rio de Janeiro, while in the same year the Treaty on the European Union, known as the Maastricht Treaty, was signed, through which sustainable development was also promoted (Stafford-Smith et al., 2017). Five years later, in 1997, the Kyoto Protocol was signed, which provided for cooperation in the protection of the environment in relation to the greenhouse effect, through the transnational exchange of know-how, while at the same time the Treaty of Amsterdam was also signed, which marked some progress in several policies (Boyle & Freestone, 1999). The most significant development has been the transfer to the wing of the European Community, which is governed by the Community method of decision-making, of policies related to the free movement of persons, in particular matters relating to visas, asylum, and immigration.⁸

Additionally, in 2002, the UN World Conference on Sustainable Development, also known as "Rio+10" (World Summit on Sustainable Development - WSSD), was held in Johannesburg, where "Local Agenda 21" was adopted. A little later, in 2009, the

⁸ http://www.europedia.moussis.eu/books/Book_2/2/2/3/?lang=gr&all=1&s=1&e=10

Conference on Climate Change was held in Copenhagen, which led to the adoption of a binding global agreement regarding further measures to limit carbon dioxide gas emissions. In addition, in 2012 the UN World Conference on Sustainable Development, also known as "Rio+20" (United Nations Conference on Sustainable Development - UNCSD) was held in Rio. However, the account of events since 2002 has been disappointing. Finally, from 2014 until last year, in 2017, there followed a series of World Conferences on Climate Change by the United Nations Organization, in New York (2014), Paris (2015) and Bonn (2017). As stated above, the contribution of International Organizations and collective intergovernmental bodies, and especially the United Nations Organization, played and play an important role in the promotion and effective implementation of viable-sustainable development (Boyle & Freestone, 1999).

1.3 Sustainable Development Goals

The goal of sustainable development is to meet the needs of current generations without jeopardizing the ability of future generations to meet their own needs as already mentioned in paragraph 1.1. Sustainable development constitutes an integrated approach that includes economic, social, and environmental aspects which reinforce each other which was mentioned in paragraph 2.1.2. The Sustainable Development Goals are a set of 17 goals (Sustainable Development Goals - SDG) that concern future international development. They were established by the United Nations and projected as the global goals for sustainable development. The goals will be implemented from 2015 to 2030. The sustainable development goals are detailed below.⁹

- Ending poverty in all its forms, everywhere.

While global poverty rates have more than halved since 2000, one in ten people in developing regions still live below the international poverty line of \$1.90 a day. Significant progress has been made in many East and Southeast Asian countries, but 42% of the population in sub-Saharan Africa still lives below the poverty line.

⁹ https://ec.europa.eu/info/strategy/international-strategies/global-topics/sustainable-development-goals/eu-approach-sustainable-development_el

Manifestations of poverty include hunger and malnutrition, limited access to education, social discrimination and exclusion, and lack of participation in decision-making. Social protection systems must be implemented to help countries affected by disasters and to provide support in the face of major financial risks (Littlewood and Holt, 2018, Rahdari et al., 2016). These systems will help strengthen the responses of affected populations to unexpected economic losses during disasters and ultimately contribute to the eradication of extreme poverty¹⁰.

- End hunger, achieve food security, and improve nutrition, and promote sustainable agriculture.

It is time for people to rethink the way they grow, share, and consume their food. Done right, agriculture, forestry and fisheries can provide nutritious food for all and generate decent incomes, while supporting people-centered rural development and environmental protection. Currently, soils, fresh water, oceans, forests, and biodiversity are rapidly being degraded. Climate change is putting even more pressure on resources, increasing the risks associated with disasters such as droughts and floods (Littlewood and Holt, 2018, Stenn, 2017). Many rural women and men can no longer survive on their land, forcing them to migrate to cities in search of opportunities. A radical change of the global food and agriculture system is needed to meet the 795 million hungry people and an additional 2 billion expected by 2050. The food and agriculture sector offers integrated solutions for development and is central to hunger and the eradication of poverty.¹¹

- Ensuring healthy living and promoting good health for all and for all ages.

Ensuring healthy lives and promoting well-being for all and at all ages is essential for sustainable development. Significant strides have been made in increasing life expectancy and reducing some of the fatal causes associated with child and maternal mortality. Significant progress has been made in increasing access to clean water and sanitation, curbing the spread of malaria, tuberculosis, polio, and HIV/AIDS. However, much more effort is needed to fully eradicate a wide range of diseases, as well as work on addressing many persistent and diverse and emerging health issues.¹²

¹⁰ <https://www.un.org/sustainabledevelopment/poverty/>

¹¹ <https://www.un.org/sustainabledevelopment/hunger/>

¹² <https://www.un.org/sustainabledevelopment/health/>

- Ensuring free, equal, and quality education by promoting opportunities for lifelong learning.

Acquiring a quality education is the foundation for improving people's lives and sustainable development. Significant progress has been made towards increasing access to education at all levels and increasing school enrollment rates, particularly among women and girls. Basic literacy skills have greatly improved, but bolder efforts are needed to make even greater progress in meeting the global goals for education. For example, parity in primary education between boys and girls has been achieved worldwide, but few countries have achieved this goal at all levels of education¹³.

- Ensuring access to water and sanitation for all.

Clean, accessible water is a very important commodity for the world to survive. There is enough fresh water on the planet to achieve this. But because of a bad economy or poor infrastructure, every year millions of people, mostly children, die from diseases related to the provision of inadequate water, sanitation, and hygiene. Water scarcity, poor water quality and inadequate sanitation negatively affects food security, livelihood options and educational opportunities for poor families around the world (Flick, 2009, Sciberras and Silva, 2018). Drought is affecting some of the world's poorest countries, exacerbating hunger and malnutrition. By 2050, at least one in four people are likely to live in a country affected by chronic or frequently recurring freshwater shortages¹⁴.

- Ensuring access to affordable, reliable, sustainable, and modern forms of energy for all.

Energy is central to almost every major challenge and opportunity facing the world today. Whether it is for jobs, security, climate change, food production or increasing incomes, access to energy for all is necessary. Sustainable energy is an opportunity – an important part for lives, economies, and the planet. UN Secretary-General Ban Ki-

¹³ <https://www.un.org/sustainabledevelopment/education/>

¹⁴ <https://www.un.org/sustainabledevelopment/water-and-sanitation/>

moon is leading a Sustainable Energy for All initiative to ensure universal access to modern energy services, improve efficiency and increase the use of renewable energy sources.¹⁵

- Promote sustainable and inclusive economic growth, employment, and decent work for all.

About half of the world's population still lives on the equivalent of about US\$2 a day. And in too many parts of the world, having a job does not guarantee the ability to escape poverty. This slow and uneven progress requires everyone to review and retool economic and social policies aimed at eradicating poverty. The continued lack of decent work opportunities, under-investment, and under-consumption lead to an erosion of the basic social conventions that govern democratic society: that development must be shared (Stafford-Smith et al., 2017). Creating quality jobs will continue to be a major challenge for almost all economies beyond 2015. Sustainable economic growth will require societies to create the conditions that allow people to have quality jobs that will stimulate the economy, while not they will harm the environment. Employment opportunities and decent working conditions are also required for the entire working-age population.¹⁶

- Creating flexible infrastructure, promoting sustainable industrialization, and fostering innovation.

Investments in infrastructure – transport, irrigation, energy and information and communication technology – are vital to achieving sustainable development and empowering communities in many countries. It has long been recognized that increasing productivity and incomes, as well as improving health and education, require investment in infrastructure. Sustainable and inclusive industrial development is the main source of income generation, enables a rapid and steady increase in living standards for all people, and provides the technological solutions for environmentally sound industrialization. Technological progress is the foundation of efforts to achieve environmental goals, such as increased resource and energy efficiency (Poddar et al., 2019, Schönherr et al., 2017). Without technology and it will not happen, and without

¹⁵ <https://www.un.org/sustainabledevelopment/energy/>

¹⁶ <https://www.un.org/sustainabledevelopment/economic-growth/>

industrialization, development will not happen.¹⁷

- Reducing inequalities within and between countries.

The international community has made significant strides towards lifting people out of poverty. The most vulnerable nations – least developed countries, landlocked developing countries and small island developing states – continue to make strides in poverty reduction. However, inequality persists and there are large differences in access to health and education services and other issues. Furthermore, while income inequality between countries may have decreased, inequality within countries has increased (Alphaliner, 2019). There is a growing common recognition that economic growth is not sufficient to reduce poverty if it is not inclusive and if it does not include the three dimensions of sustainable development – economic, social, and environmental. To reduce inequalities, policies should be global, prioritizing the needs of disadvantaged and marginalized populations.¹⁸

- Cities to be safe, inclusive, and sustainable.

Cities are centers for ideas, commerce, culture, science, productivity, social development and more. At their best, cities have enabled people to develop socially and economically. However, there are many challenges to sustaining cities in such a way that they continue to create jobs and prosperity while not draining land and resources. Common urban challenges include congestion, lack of funds to provide basic services, lack of adequate housing and declining infrastructure (Yuen, 2018). The challenges facing cities can be overcome in ways that allow them to continue to thrive and grow, while improving resource use and reducing pollution and poverty. The future everyone wants includes cities with opportunities for all, with access to basic services, energy, housing, transportation and more.¹⁹

- Ensuring sustainable consumption and production standards.

Sustainable consumption and production means promoting resource and energy sufficiency, sustainable infrastructure, and providing access to basic services, green

¹⁷ <https://www.un.org/sustainabledevelopment/infrastructure-industrialization/>

¹⁸ <https://www.un.org/sustainabledevelopment/inequality/>

¹⁹ <https://www.un.org/sustainabledevelopment/cities/>

and decent jobs, and a better quality of life for all. Their implementation will contribute to achieving overall development plans, reducing future economic, environmental, and social costs, enhancing economic competitiveness, and reducing poverty. Sustainable consumption and production aim to "do more and better with less", increasing net profits from economic activities by reducing resource use, degradation, and pollution throughout the life cycle, while improving quality of life. It involves various stakeholders, including businesses, consumers, policy makers, researchers, scientists, retailers, the media, as well as development cooperation organizations, among others (Yuen, 2018). It also requires a systemic approach and the cooperation between actors active in the supply chain, from the producer to the final consumer. It also includes consumer engagement through awareness and education on sustainable consumption and lifestyle, providing consumers with adequate information through standards and labels and participating in sustainable public procurement, among others.²⁰

- Taking urgent action to combat climate change and its effects.

Climate change now affects every country on every continent. It disrupts national economies and affects lives, costing people, communities, and countries dearly today and even more tomorrow. Humans are experiencing significant impacts of climate change, which include changing weather conditions, rising sea levels, and more extreme weather events. Greenhouse gas emissions from human activities drive climate change and continue to rise (Yuen, 2016). They are now at the highest levels in their history. Without action, the planet's average surface temperature is projected to rise in the 21st century and is likely to rise by 3 degrees Celsius this century, with some areas of the world expected to warm even more. The poorest and most vulnerable people are most affected. Affordable, scalable solutions are now available to enable countries to move towards cleaner, more resilient economies. The pace of change is accelerating as more people turn to renewable energy and a range of other measures will reduce emissions and increase adaptation efforts. But climate change is a global challenge that does not respect national borders. Gas emissions affect people everywhere. This is an issue that requires internationally coordinated solutions and

²⁰ <https://www.un.org/sustainabledevelopment/sustainable-consumption-production/>

requires international cooperation to help developing countries move towards a low-carbon economy. To tackle climate change, countries are working to adopt a global agreement in Paris next December²¹.

- Conservation and sustainable use of oceans, seas, and marine resources.

The world's oceans – their temperature, chemistry, currents, and life – drive the global ecosystems that make Earth habitable for humanity. Rainwater, drinking water, weather, climate, coastlines, much of the nutrition and even the oxygen in the air are provided and regulated by the sea. Throughout history, oceans and seas have been vital to trade routes and transportation. Careful management of this important global resource is a key feature of a sustainable future.²²

- Sustainable forest management, combating desertification, halting, and reversing soil degradation, halting the loss of biodiversity.

Forests cover 30 percent of the Earth's surface and in addition to providing food security and shelter, forests are key to combating climate change, protecting biodiversity and the homes of indigenous people. Thirteen million hectares of forests are lost every year, while the ongoing degradation of arid areas has led to the desertification of 3.6 billion hectares. Deforestation and desertification – caused by human activities and climate change – are major challenges to sustainable development and have affected the lives and livelihoods of millions of people in the fight against poverty.

Efforts are being made to manage forests and combat desertification.²³

- Promoting just, peaceful, and inclusive societies.

Goal 16 of the Sustainable Development Goals is dedicated to promoting peaceful and inclusive societies for sustainable development, providing access to justice for all, and building effective institutions at all levels²⁴.

²¹ <https://www.un.org/sustainabledevelopment/climate-change-2/>

²² <https://www.un.org/sustainabledevelopment/oceans/>

²³ <https://www.un.org/sustainabledevelopment/biodiversity/>

²⁴ <https://www.un.org/sustainabledevelopment/peace-justice/>

1.4 Principles of Sustainable Development

Sustainable-sustainable development, in addition to an expanded field of goals, is also characterized by a large and varied number of principles that govern its implementation. The strategy followed in the context of achieving a development, which satisfies all three pillars of viability-sustainability, must be governed by the following framework: It must contribute to an integrated approach of social, economic and environmental policies, seek action so that they evolve patterns of consumption, production, focus on structural issues, promote social consensus, cultivate adaptability with political processes, expand the capacity of institutions and social groups and have a clear orientation to specific goals (Karvounis & Georgakelos, 2003). The basic principles are analyzed as follows:

- Principle of the holistic approach. Things must be seen as a system of interrelated elements, while the elements themselves are interactions with each other. Any interference can cause instability phenomena. Thus, local challenges can be adequately addressed, based on knowledge of the wider environment and global trends.
- Principle of intergenerational solidarity. The interests of sustainable development are centered on people. The development and environmental needs of present generations must be met without compromising the ability of future generations to meet their own needs.
- Principle of social justice. The right to adequate living conditions must be recognized and fundamental human rights must be guaranteed for all. All people should have equal opportunities to acquire the knowledge and skills needed to become worthy members of society.
- Principle of sustainable resource management. Sustainable resource management based on environmental carrying capacity limitations - using natural resources wisely and economically conserves resources needed for

future development. Biodiversity is also a natural resource, and we give high priority to its preservation.

- Principle of integration. When developing, evaluating, and implementing sectoral policies, plans and programs, economic, social and environmental aspects and their interrelationships must also be taken into account in order to ensure mutually reinforcing interdependence. Local, regional, and national activities must be coordinated.
- Principle of public participation. Sufficient access to information affecting social, economic life and the environment, information on decision-making processes must be provided for all. People's knowledge of sustainable development, its social, economic, and environmental impacts and sustainable solutions and approaches must be clarified and strengthened. Public participation in decision-making needs to be strengthened.
- Principle of precaution and prevention. Human activities must be planned and carried out in accordance with this precautionary principle whose objective is to ensure a high level of environmental protection through proactive decision-making in cases of risk²⁵. Also, activities that damage or pollute the environment endangering natural systems and human health must be prevented and, where this is not possible, reduced as much as possible.
- "Polluter pays" principle. Prices should reflect the real costs society pays for consumption and production activities and their impacts, including the cost of using natural resources. Those engaged in activities that destroy or pollute the environment must pay for the damage caused to human health or the environment²⁶.

²⁵ <https://eur-lex.europa.eu/legal-content/EL/TXT/?uri=LEGISSUM%3A132042>

²⁶ https://www.tankonyvtar.hu/en/tartalom/tamop425/0032_kornyezeti_ranyitas_es_minosegbiztositas/ch04s02.html

- Principle of preservation of cultural heritage. Sustainable development has emphasized the preservation of social traditions, customs, religious places and cultural aspects of the people. Diverse cultural heritage is society's invaluable contribution, but superstition must be avoided. The preservation of cultural heritage is the duty of all people. Its preservation supports sustainable development.

- Principle of bearing capacity. It refers to the data and capabilities of a system to meet the demands of human use so that it does not deteriorate or degrade.
²⁷Essentially, it is the number of species or units of a species that can be sustained indefinitely by an ecosystem without its degradation.²⁸

After referring to the principles, it is realized that sustainable development requires the elimination of fragmentation, i.e. environmental, social and economic concerns must be integrated into all decision-making processes in order to have a truly sustainable development²⁹.

²⁷ <https://www.kullabs.com/classes/subjects/units/lessons/notes/note-detail/1182>

²⁸ <https://www.rodiaki.gr/article/45395/feroysa-ikanothta-kai-anaptyxh>

²⁹

https://sustainabledevelopment.un.org/content/documents/5839GSDR%202015_SD_concept_definiton_rev.pdf

Chapter 2. The application of sustainable development in shipping

As mentioned above in section 1.3 the 193 UN Member States unanimously adopted an Agenda for Sustainable Development including the 17 SDGs.

In particular, international shipping greatly benefits the world by moving food, goods, raw materials reliably and efficiently around the world at low cost (Edwards 1993). In cooperation with ports and other stakeholders in the shipping industry, international shipping is essential for the functioning of world trade since it connects producers, manufacturers, and consumers, with each other.³⁰ On the other hand there are certain effects of shipping on the environment (eg pollution) or society (eg working conditions during ship breaking) which it is desirable to improve. The IMO plays a key role in the implementation of a number of UN Sustainable Development Goals that directly or indirectly affect the oceans, environmental protection and the shipping industry³¹.

2.1. The implementation of the IMO goals in the development of sustainable shipping

Sustainable maritime transport is an important factor for most SDGs. While each SDG addresses a different aspect of sustainability, the SDGs are at the same time interconnected. Therefore, some IMO activities may contribute to more than one objective. The connection between the work of the IMO and the SDGs as formulated by the United Nations is described below:



³⁰ <http://www.imo.org/en/MediaCentre/HotTopics/Documents/IMO%20SDG%20Brochure.pdf>

³¹ <https://www.marinelink.com/news/implementing-sustainable427489>

- Conservation and sustainable use of oceans, seas, and marine resources for sustainable development.

Goal 14 is the quintessential shipping-related sustainable development goal (Pedersen 2018). International shipping takes place in the world's oceans, and the IMO is responsible for measures to improve safety, to ensure international shipping and to prevent pollution from ships. Therefore, IMO's work addresses most, if not all, of the SDG 14 goals, particularly with regard to the environment. The implementation and enforcement of the main conventions and regulations adopted by the IMO address marine pollution, mainly from marine sources but also indirectly, from land-based sources, for example through the 1972 London Convention and the 1996 Protocol (London Convention and Protocol - LC / LP) regulate the discharge of wastes and other waters into the sea IMO also supports the objectives for the management and protection of marine and coastal ecosystems, through the designation of special areas under the International Convention for the Prevention of Pollution from ships (the International Convention for the Prevention of Pollution from ships - MARPOL) as will be mentioned in chapter 3.

The fundamental purpose of IMO, as described in the IMO Convention, is rooted in the conservation and sustainable use of oceans and resources. This foundation is again reflected in the links between the IMO treaty and the United Nations Convention on the Law of the Sea (UNCLOS) (Psaraftis 2019). The IMO is inter alia responsible for UNCLOS for safe navigation, for the safety of life at sea, including the design, construction, equipment, and manning of ships. It is also responsible for safety and environmental protection, and liability and compensation for marine accidents. Acting as a competent organization through such a wide range of activities, IMO has an important role to play in achieving SDG 14.

The IMO also works with the Food and Agriculture Organization of the United Nations (FAO) to tackle illegal, unregulated, and unregulated fishing.



- End poverty in all its forms.
- End hunger, achieve food security, improve nutrition and promote sustainable agriculture.
- Promoting peace and integrated companies for sustainable development, providing access to justice for all and effective organizations at all levels.

Goals 1, 2, 16 are also sustainable development goals related to shipping (Allal et al. 2018). As the most cost-effective and fuel-efficient way to transport goods, maritime transport is at the heart of global trade and globalization. Global trade and maritime transport sustain economic growth and the spread of prosperity around the world. Improving access to basic materials, goods and products is expected to lift millions of people out of poverty and thereby contribute to the achievement of SDGs 1 and 2.

The IMO, through its regulations, facilitates a global maritime transport system that connects markets and moves 80% of world trade. But, for this system to flow effectively, without unnecessary delay, it must be supported by a global system of laws and regulations that are unified in its development and execution. IMO also helps developing countries build effective institutions to ensure the safety, security and environmentally friendly flow of maritime trade (Ringbom 2018). Finally, the IMO protects the legal rights of those affected by an incident of pollution or loss on board passenger ships. The continued efficient operation of the shipping sector allows trade to flow freely around the world.



- Ensuring quality education and enhancing lifelong learning opportunities for all.
- Achieving gender equality and empowering all women and girls.
- Promoting safe and sustainable economic development, professional and productive employment, and job restoration for all.

Furthermore, goals 4, 5, 8 are the pre-eminent sustainable development goals related to shipping. International shipping and related industries depend on qualified seafarers and shore personnel to support ship operations. The maritime community contributes to the quality of life, particularly in developing countries by employing 1.5 million seafarers thereby directly enhancing the economic well-being of local communities. The insurance and safety of life at sea, the protection of the marine environment and the efficient movement of global trade depend on the professionalism and competence of seafarers.

The IMO also contributes to integration and quality education by providing training activities, in particular through technical cooperation programs and the two maritime educational institutions - the World Maritime University (WMU) and the International Maritime Law Institute (the International Maritime Law Institute - IMLI). In particular, WMU is a center of excellence for maritime postgraduate education and research, promoting the highest standards in the teaching of maritime affairs and bringing together young people from diverse educational, cultural and social backgrounds to study and live together. IMLI helps ensure sufficient experts in the field of maritime law to assist in the implementation and enforcement of international maritime law, particularly in developing countries. The above contributes to the achievement of SDG 4 and 8.

Finally, IMO promotes gender equality and women's empowerment through targeted training opportunities for women in the maritime sector. In particular, it provides access to specialized training, the promotion of economic autonomy, and the improvement of job opportunities for women in decision-making at the port and maritime sector levels. This is how SDG 5 is achieved.



- Ensuring availability and sustainable management of water for all.
- To make cities and human settlements safe, resilient and sustainable.
- Ensuring sustainable consumption and production patterns.

Additionally, goals 6, 11 and 12 are the pre-eminent sustainable development goals related to shipping. SDG 12 and, by extension, SDG 6 and 11, address sustainable production and consumption patterns and resource management, including waste management. The IMO has developed a number of important regulations related to this set of SDGs, in particular the LC / LP, the Hong Kong Ship Recycling Convention and MARPOL which will be described in detail in chapter 3.

The LC / LP contributes to SDG 6 on sustainable water management by prohibiting unregulated waste disposal at sea. In this regard, the IMO provides support to developing countries by helping them to strengthen their legislative, scientific, and technological capabilities.

The Hong Kong Ship Recycling Convention contributes to SDG 12 by reducing waste generation and promoting sustainable consumption. In addition, IMO contributes to SDG 12 through the reduction of waste generation, both operational waste from ships

and discharge of waste under LC / LP according to MARPOL Annex V which will be mentioned in section 3.1.5.



- Ensuring access to affordable, reliable, sustainable, and modern energy for all.
- Taking action to combat climate change and its impacts.

Also, goals 7 and 13 are the pre-eminent sustainable development goals related to shipping. The IMO seeks to combat climate change including air pollution, energy efficiency and greenhouse gas (GHG) emissions. The IMO ensures that the shipping sector can continue to improve effectively, thereby promoting trade and the provision of services with cost-effective energy across the globe.

The maritime sector and the IMO have an important role to play in achieving SDG 7, particularly on energy efficiency, and SDG 13 on climate change. The IMO has worked extensively to address GHGs from shipping and, in 2011, the first mandatory, global, legally binding GHG control regime was adopted on technical measures for new ships and operational emissions for all ships.



- Building resilient infrastructure, promoting sustainable industrialization and innovation.
- Reducing inequalities within and between countries.

- Strengthening the means of implementation and revitalizing the global partnership for sustainable development.

Next, goals 9, 10 and 17 are the pre-eminent sustainable development goals related to shipping. Within the UN, the IMO contributes to SDG 10 by providing all Member States with a platform for discussion and exchange of views in its various committees and meetings.

IMO contributes to SDG 9 by providing a legal and regulatory framework, capacity-building initiatives and a forum for Member States to share knowledge and experience. In addition, the IMO contributes to SDG 9 mainly through the Convention on Facilitation of International Maritime Traffic (FAL). The main objective of the FAL contract is to achieve maximum efficiency in maritime transport. By reducing the red tape and procedures associated with the arrival, stay and departure of ships on international voyages, it allows ships, cargo, and passengers to move smoothly from one port to another. It also encourages the use of modern information and technological communications and the exchange of electronic information between ships and ports. This performance has a clear benefit to trade and, therefore, to the economy.

Finally, the IMO allows ships to transit smoothly between ports. SDG 17 calls for global partnerships, not only between countries, but also other multinational actors, to support the achievement of the SDGs in all countries, especially developing ones. These partnerships must share knowledge, expertise, technology, and financial resources. Currently, the IMO has several corporate agreements. These partnerships provide valuable support for the development of capable activities³².

³² <http://www.imo.org/en/MediaCentre/HotTopics/Documents/IMO%20SDG%20Brochure.pdf>

2.2. Comparison of the IMO Framework and the UN 2030 Agenda for Sustainable Development

The technical cooperation committee discussed and approved (17-19 July 2017) the relationships between IMO's technical assistance work and the 2030 agenda for sustainable development as mentioned above in section 1.3. The committee noted that all of the Sustainable Development Goals had some relevance to the IMO's mandate, but the eight that the Committee considered most relevant to IMO's technical assistance work were identified, classified and linked to the IMO's Strategic Directions. The table below shows the links between IMO's technical assistance work and the 2030 Agenda for Sustainable Development. Member States are invited to highlight the links shown in the attached table and promote a better appreciation of the maritime sector's contribution and role of technical assistance work in achieving the sustainable goals.

Table 1 Link between IMO's technical assistance work and the 2030 Agenda for Sustainable Development.
Source: <http://www.imo.org/en/MediaCentre/HotTopics/Documents/TC.1-Circ.69.pdf>

Examples of IMO technical assistance activities	Sustainable Development Goals (SDGs)	Strategic Directions IMO
- Strengthening the capacity of developing countries to implement the IMO conventions and ensure safe, secure and environmentally protective flow of maritime trade.	SDG 1: End poverty in all its forms everywhere.	1
- Promotion of the ratification and implementation of the facility agreement.	SDG 2: End hunger, achieve food security and improve nutrition and promote sustainable agriculture.	2 5
- Providing assistance to Member States to implement the ISPS Code and the SUA Convention.	SDG 16: Promote peaceful relations, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.	6
- Particular attention is paid to		

the special needs of Small Island Developing States and least developed countries.

- Promote the ratification and strengthen the effective implementation and enforcement of the **SDG 14: Conservation and sustainable use of oceans, seas and marine resources for sustainable development.** * 1 4

MARPOL, OPRC, SOLAS, OPRC-HNS and BWM Conventions.

- Strengthening the national capacity to deal with marine pollution incidents and strengthening regional cooperation.

- Assisting countries to develop and adopt relevant aspects of UNCLOS.

- Creation of special areas under MARPOL and particularly sensitive sea areas (PSSAs).

- Particular attention is paid to the special needs of developing countries, Small Islands and less developed countries.

- Support ratification and implementation of the Cape Town Agreement.

- Promoting the ratification and implementation of the **SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning** 1 2
STCW and STCW-F

Conventions.	opportunities for all. *
- Cooperation with the ILO Joint IMO/ILO Ad Hoc Working groups to deal with various issues concerning the health and social protection of seafarers.	SDG 5: Achieve gender equality and empower all women and girls. *
- Continuation of the promotion and implementation of the program to strengthen the role of women in the shipping sector.	SDG 8: Promote sustainable and inclusive economic growth, full and productive employment and decent work for all.
- Continue to promote scholarships for WMU, IMLI and other maritime education institutions.	
- Promote the ratification and strengthening of the effective implementation of Annex VI of the MARPOL Convention.	SDG 7: Ensure access to 1 affordable, reliable, 2 sustainable and modern 3 energy for all. *
- Greenhouse gas emissions management plans, EEDI, SEEMP.	SDG 13: Take urgent action 4 to combat climate change and its impacts. *
- Promoting the ratification and implementation of the London Convention and the London Protocol.	
- Implementation of the GloMEEP project and creation of a global network of Marine Technology Cooperation Centers	

(MTCC).

- Particular attention is paid to the special needs of Small Island Developing States and least developed countries.

- Promoting the ratification and implementation of the London Convention and the London Protocol. **SDG 6:** Ensure the availability and sustainable management of water and sanitation for all. * 1 4

- Promote the ratification and strengthening of the effective implementation and enforcement of MARPOL Annex V. **SDG 11:** Make cities and people's homes inclusive, safe, resilient and sustainable.

- Promote the ratification and implementation of the Hong Kong Convention on Ship Recycling. **SDG 12:** Ensure sustainable consumption and production models.

- Promoting the use of maritime country profiles by Member States and implementing national maritime transport policies. **SDG 9:** Build resilient infrastructure, promote sustainable and inclusive industrialization and promote innovation.* 1 2

- Promotion of the ratification and implementation of the facility agreement. **SDG 10:** Reducing inequalities within and between countries. 6

- Continue to develop and strengthen bilateral partnerships with governments, international organizations, regional institutions and industry to implement technical **SDG 17:** Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development. * 6

cooperation activities.

* Highlighted SDGs (4, 5, 6, 7, 9, 13, 14 and 17) denote those directly related to IMO technical assistance.

IMO's strategic directions are:

SD1: Improvement of the application

SD2: Integrating new and advanced technologies into the regulatory framework SD3:
Responding to climate change

SD4: Participation in ocean governance

SD5: Enhancing global facilitation and security of international trade SD6: Ensuring regulatory effectiveness.³³

More specifically, from table 1. it appears that from the UN framework, the IMO is identified with some parties. First, the activity of the IMO to promote the ratification and strengthening of the effective implementation of the MARPOL conventions, the International Convention for the Safety of Life at Sea (SOLAS), etc. . for dealing with marine pollution refers to SDG 14. Also, promoting the implementation of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) and the The International Convention on Standards of Training, Certification and Watchkeeping for Fishing Vessel Personnel (STCW-F) of the IMO is identified with SDG 4 which ensures the training and promoting opportunities for all. Subsequently, IMO's activity to develop the Joint IMO/ILO Ad hoc working groups program on liability and compensation in relation to claims for death, injury and abandonment of seafarers (Joint IMO/ILO Ad hoc working groups) to strengthen role of women in the shipping sector is related to SDG 5 which aims for gender equality. Furthermore, an IMO technical assistance activity is to strengthen the effective implementation of MARPOL Annex VI which deals with regulations for the prevention of air pollution from ships and which is identified with SDG 7. In addition, the IMO activity on projects management of greenhouse gas emissions based on the

³³ <http://www.imo.org/en/MediaCentre/HotTopics/Documents/TC.1-Circ.69.pdf>

Energy Efficiency Design Index (EEDI) and the Ship Energy Efficiency Management Plan (SEEMP) are directly related to SDG 13 which concerns the measures to combat climate change. In addition, the ratification and implementation of the London Convention and the London Protocol refer to SDG 6, i.e. sustainable water management. Furthermore, the activity of the IMO to promote the use of maritime spaces by the member states and the implementation of national policies for maritime transport is identified with SDG 9, that is, the creation of resilient infrastructure and the promotion of sustainable industrialization. Finally, in the last part where the IMO is identified with the UN, it is in the strengthening of partnerships with governments, international organizations for the implementation of technical cooperation activities that refer to SDG 17 which is also the last goal of the UN.

2.3. Sustainable Development in the European Union

The European Maritime Safety Agency (EMSA) is an organization of the European Union, which deals with reducing the risk of maritime accidents, marine pollution from ships and loss of life at sea, helping to enforce the relevant of EU (European Union) legislation and is headquartered in Lisbon. Its role is the same as that of the IMO, with the difference that the latter is a United Nations Organization. More specifically, EMSA has regional responsibilities, while IMO is a global body that ultimately depends on the United Nations. The IMO is the regulator at international level, responsible for the conventions that underpin maritime safety (MARPOL, STCW, etc.). European Community regulations and directives are complementary to those of the IMO. EMSA has no regulatory or legislative function. It is an executor and monitor of maritime policy, but it is not its creator. EU policy and legislation is the responsibility of the European Commission, the European Council and the European Parliament.³⁴

³⁴ <http://www.emsa.europa.eu/about/faq/175-governance/343-is-emsa-a-competitor-to-the-international-maritime-organization-imo.html>

2.3.1. The tasks of EMSA

EMSA undertakes certain, mainly preventive, tasks in certain key areas to achieve its objectives, which correspond to those of the IMO. Examples are listed below:

Firstly, the Agency is tasked with assisting the Commission in monitoring the implementation of EU legislation on ship construction and planned maintenance, ship inspection and waste reception in EU ports, certification of ship equipment, training of seafarers in non-EU countries and port state control.

Second, the Agency operates, maintains, and develops EU-wide maritime information capabilities. Important examples are the SafeSeaNet vessel tracking system, which enables the tracking of vessels and their cargo across the EU.

In parallel, a European oil spill response network was created, as well as CleanSeaNet, which is a European satellite oil spill monitoring and ship detection service contributing to an effective system to protect EU coasts and waters from ship pollution.

Finally, the Agency provides technical and scientific advice to the Commission in the field of maritime safety and the prevention of pollution from ships in the continuous process of evaluating the effectiveness of the measures applied and in updating and developing new legislation. It also supports and facilitates cooperation between Member States and disseminates best practices.³⁵

The tasks of the European Sustainable Shipping Forum (ESSF) are to assist the Commission in the implementation of Union activities and programs aimed at promoting sustainable maritime transport. The ESSF provides a platform for structured dialogue, exchange of technical knowledge, cooperation and coordination between Member States and stakeholders in the maritime transport sector³⁶.

³⁵ <http://www.emsa.europa.eu/about/what-we-do-main.html>

³⁶ <http://emsa.europa.eu/main/sustainable-toolbox/relevant-eu-projects.html>

2.4. The Sustainable Shipping Initiative (SSI)

As already mentioned, many efforts are being made regarding the promotion and adoption of sustainable shipping and sustainable development in general. In this context, the structure of a non-governmental organization, whose main objective is the adoption of policies by all involved bodies for sustainable shipping, will be known. By knowing the *raison d'être*, the action and the vision of this organization, the significant role of sustainable shipping in the maritime activity is better understood.

In particular, SSI is an independent organization made up of charterers and shipowners, shipyards and technology companies, covering the entire economic cycle of shipping companies, whose common goal is to make the integration of sustainability possible. SSI works with its members and other shipping partners to create a more environmentally responsible, socially conscious, safer and more cost-effective industry by 2040³⁷.

2.4.1 Grouping of initiatives into categories

Over the past decade, several proactive efforts have emerged to encourage environmental management improvements in the shipping industry. These have been referred to as sustainable or green shipping initiatives. The initiatives are varied but can be grouped by the following:

- **Research and innovation:** These initiatives aim to reduce or eliminate harmful environmental emissions and include investments in research and technological design to make ships safer and more sustainable.
- **Corporate Social Responsibility:** The European Commission defines Corporate Social Responsibility (CSR) as "A concept whereby companies integrate social and environmental concerns into their business activities and interactions with stakeholders on a voluntary basis. " Shipping that operates with high environmental

³⁷ <https://www.ssi2040.org/>

standards can achieve indirect benefits by promoting the company, improving its image. CSR is usually integrated into the company's marketing strategy.

- Awareness and environmental education: Emphasis on initiatives aimed at education and awareness, encouraging environmental management improvements across the sector.
- Voluntary class symbols and certifications: Environmental class symbols provided by the various classification societies help to improve design, construction, and practice for environmental safety. During their annual surveys, classifiers can review the ship's certification and environmental performance.
- Protecting the environment: Shipping businesses that maintain a healthy environment benefit the wider human good and the shipping industry as a whole, especially as awareness of climate change grows.
- The Marine Stewardship Council (MSC): is an independent non-profit organization that implements a fisheries certification and ecolabel program. The mission is to reward sustainable fishing practices and through their eco-label they help consumers make sustainable choices when purchasing seafood.³⁸

2.4.2. The challenges faced by SSI

In May 2011, SSI launched a case for action which explored the social, environmental, and economic challenges facing the industry and how best to respond to them. Leading businesses, including fleet operators, their suppliers, customers, and stockbrokers, looked to 2040 and made a case for action to create an industry with higher social and environmental standards. The case for action was based on interviews with experts from across the shipping sector. It is worth noting that the case for action was not an attempt to predict the future, but an attempt to raise

³⁸https://www.wwf.at/de/view/files/download/showDownload/?tool=12&feld=download&sprach_conn ect=2395

awareness and start a dialogue about how the shipping business environment needs to change.

SSI identified 7 global trends as part of the case for action, the global economy, ocean governance, demand for transparency, the future of energy, sustainability regulation, technology advancement and climate change adaptation, which must be taken into account as he judges that they will profoundly affect the shipping sector over the next 30 years. In fact, the interaction of these global trends and three key challenges for the industry was examined. At this point, it is considered necessary to mention the three main challenges, which SSI considered to be a threat to the environment and shipping activity³⁹. Particularly:

Challenge 1: Navigating a Changing Economic Context

During the next 30 years there are likely to be rapid and significant changes in the direction of trade and the type of goods carried. An industry as highly variable and uncertain by nature as shipping needs to be well equipped to deal with this.

Challenge 2: Increased scrutiny, higher expectations

The customer of the future cares about price, safety and speed, but also about wider performance factors such as working conditions, ship efficiency, emissions, biodiversity and environmental and labor law enforcement. Codes of conduct for shipping are expected to be rapidly disseminated. Soon, sophisticated remote monitoring technology will be applied to it.

Challenge 3: The future of energy and climate change

Volatile oil prices and insecurity of supply are likely to pose a significant challenge to shipping and the wider economy. At the same time, climate change offers increasingly alarming indications of global warming. Shipping companies and their partners recognize the need to invest in energy efficiency and the transition to new fuels, exploring new economic models to contribute to this. However, there is uncertainty about how to invest. Short-term price fluctuations in different fuel types are a factor in this uncertainty, as is the need for concerted action to develop supply infrastructure

³⁹ <https://www.ssi2040.org/>

and competing performance requirements imposed by stringent specifications such as sulfur regulations. Strong leadership is needed to avoid uncertainty resulting in inaction.⁴⁰

2.4.3. Reference to companies that align with SSI's goals

Finally, after mentioning the importance of SSI as well as the challenges faced by the shipping industry, it is worth noting that it has already been implemented by some large global companies presented below:

2.4.3.1. The Triple-E ships



Image 4 The largest container ship of the Maersk company

Source: <https://qz.com/59923/worlds-largest-container-ships-maersk-launch-2013/>

The Triple-E ships, built for Maersk by DSME (Daewoo Shipbuilding & Marine Engineering Co, Ltd), demonstrate significantly improved energy efficiency and environmental performance compared to the industry's current most efficient ship, the Emma Maersk. These new vessels consume 50% less fuel and CO₂ than the industry average. The Triple-E vessel is only a few meters longer and wider than the Emma Maersk class but can carry 16% more containers. The ship's hull is designed for lower speeds and the energy efficient engine is combined with a heat recovery system that uses the exhaust gases to generate extra energy that helps propel the ship.

⁴⁰ <https://www.slideshare.net/forum4thfuture/ssi-case-for-action-full-report>

The millions of dollars invested in the purchase of ships are also an investment in materials, some of which are scarce resources. Triple-E ships reuse these materials for future vessels. This offers 90% recycling and shows the companies' potential to meet their raw material needs. Maersk Line has a vision that all ships built in the future should be 100% recyclable.⁴¹

2.4.3.2. Maersk Line - Achieve slow speed



Image 5 Ship moving at slow speed

Source: <https://www.vumpu.com/en/document/view/7803715/slow-steaming-the-full-story-maersk>

Slow speed is an operational strategy that has enabled Maersk Line to deliver greater schedule reliability and environmental performance. It was thought that the engines could not cope with the low loads, but Maersk proved that this could be achieved. Today, most of Maersk Line's fleet moves at slow speed, yielding annual cost savings of around \$300 million - with potential for further savings. It has also reduced CO₂ emissions by approximately 7%, contributing to Maersk Line's goal of reducing CO₂ emissions by 25% by 2020.⁴²

⁴¹ <https://www.ship-technology.com/projects/triple-e-class/>

⁴² <https://safety4sea.com/slow-steaming-remains-priority-maersk/>

2.4.3.3. BP - Activate Virtual Arrival



Image 6 Vessel operating under the "virtual arrival clause"

Source: <https://www.kingkit.co.uk/product/merit-ships--4908-bp-tanker-ss-sovereign->

If, at a contractual speed, it is clear that the ship will be waiting at the port of discharge, the parties to the voyage can activate the "dummy arrival clause". The ship then goes at a slower speed to arrive 'just in time'. This radically reduces fuel consumption and emissions and also eases traffic congestion and improves safety. The virtual arrival then calculates the time at which the vessel would have arrived without intervention and calculates the resulting waiting or "prevention" time compensation, as if the vessel had now arrived.

As a result of BP's launch and promotion of virtual arrival it is estimated that implementing virtual arrival in the tanker and truck sectors could reduce greenhouse gas emissions by 5% or 25 million tonnes of CO₂ per year.⁴³

⁴³ <http://www.intertanko.com/upload/virtualarrival/virtualarrivalinformationpaper.pdf>

2.4.3.4. Gearbulk - Achieving Environmental Waste Measurement



Image 7 Vessel which includes a system for accurate monitoring of waste streams.

Source: <https://www.glassdoor.ca/Photos/Gearbulk-Office-Photos-IMG1077000.htm>

Gear bulk has created a more comprehensive environmental measurement system to accurately track waste streams from its fleets. Existing procedures for measuring and recording waste quantities were expanded and improved. The system has automatic alarms to indicate non-receipt of regular reports and to signal when parameters deviate from preset values. It includes all significant air emissions and waste streams such as CO₂, sulfur oxides (SO_x) and nitrogen oxides (Nitrogen oxide - NO_x), sludge, garbage, cargo residues, tank washing, oil consumption, accidental oil spills and refrigerant gases.

The system is considered an essential tool for assessing the success of the initiatives mentioned in section 2.4.1. in terms of reducing emissions and waste and a potentially important role model for the wider industry.⁴⁴

⁴⁴ <https://www.gearbulk.com/>

2.4.3.5. Cargill - The Wind Power System



Image 8 The largest kite-powered ship.

Source: <https://www.shipandoffshore.net/news/shipbuilding/shipbuilding-article/id/project-agreement-for-largest-kite-powered-vessel.html>

Cargill has partnered with SkySails, which is developing an innovative technology that uses a kite flying in front of a boat to generate enough thrust to reduce fuel consumption by up to 35% in ideal sailing conditions. An IMO study estimates that up to 100 million tonnes of CO₂ could be saved each year from the widespread application of this type of technology in the global merchant fleet.

2.4.3.6. B9 Shipping – Achieving low carbon shipping

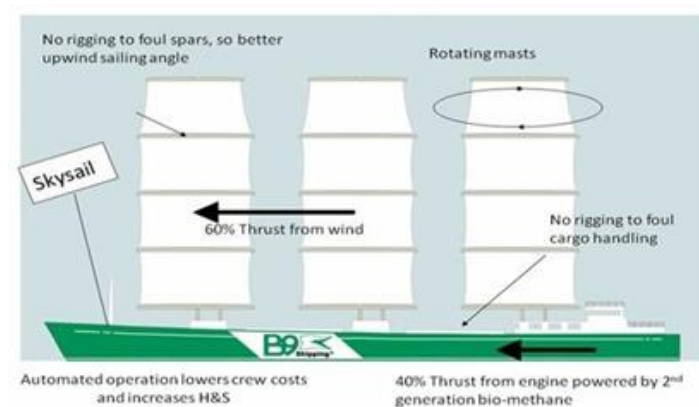


Image 9 Low carbon ship

Source: <http://blog.naver.com/PostView.nhn?blogId=dsjang650628&logNo=220679243153>

Cargill has partnered with SkySails, which is developing an innovative technology that uses a kite flying in front of a boat to generate enough thrust to reduce fuel consumption by up to 35% in ideal sailing conditions. An IMO study estimates that up to 100 million tonnes of CO₂ could be saved each year from the widespread

application of this type of technology in the global merchant fleet.⁴⁵

Chapter 3. The contribution of shipping to environmental protection

Sustainable development, as mentioned above in section 1.1.1. it consists of three components or different 'pillars': environmental, social, and economic, all of which are inextricably linked.

Shipping, which carries around 90% of world trade, is statistically the least environmentally damaging mode of transport when the value of production is taken into account. In addition, compared to land-based industry, shipping has, in general, a comparatively smaller contribution to marine pollution from human activities.

By 2025, the shipping industry expects to invest hundreds of billions of dollars in further environmental improvements. This must comply with a series of new environmental standards adopted by the IMO (Spalding 2016). These new IMO standards will need to be properly implemented on a global basis for shipping to function effectively.⁴⁶

The original mandate of the IMO was primarily concerned with maritime safety. However, the Organization, as the depositary of the 1954 International Convention for the Prevention of Pollution of the Sea by Oil (OILPOL), immediately after its launch in 1959, assumed responsibility for pollution issues. It then adopted a wide range of measures aimed at preventing and controlling pollution caused by ships and mitigating the effects of potential damage. These measures have been proven to reduce pollution from ships and illustrate the commitment of the Agency and the shipping industry to protect the environment.

It should be noted that the Marine Environment Protection Committee (MEPC) is the

⁴⁵ <https://www.cargill.com/transportation/dry-bulk-shipping>

⁴⁶ <http://www.ics-shipping.org/docs/default-source/resources/policy-tools/sustainable-development-imo-world-maritime-day-2013.pdf?sfvrsn=18>

IMO's highest technical body for marine pollution issues. ⁴⁷Below are some of the ways the shipping industry contributes to environmental protection.

3.1. Pollution prevention

In 1973, the IMO adopted the International Convention for the Prevention of Pollution from Ships, now known worldwide as MARPOL, which was amended by the 1978 and 1997 Protocols and updated with relevant amendments. MARPOL deals with pollution from ships carrying oil, noxious liquid substances carried in bulk, noxious substances carried by sea in packaged form, sewage, waste and the prevention of air pollution from ships. MARPOL has made a significant contribution to significantly reducing pollution from international shipping. Next, the Annexes of MARPOL that contribute to the prevention of pollution are presented.⁴⁸

3.1.1. MARPOL Annex I - Prevention of Oil Pollution

Oil tankers transport approximately 2,900 million tons of crude oil and petroleum products each year around the world by sea. Measures introduced by the IMO have helped to ensure that the majority of tankers are built and operated safely to reduce the amount of oil spilled in the event of an accident.

The operational and construction regulations established by MARPOL, such as the introduction of mandatory oil traffic separation systems as well as international standards for the training of seafarers, have contributed to the continuous reduction of unintentional oil pollution over the past 30 years.

The MARPOL Convention, in 1983, introduced a number of radical new concepts, such as the requirement that new oil tankers be fitted with segregated ballast tanks which will be mentioned in section 3.4.2., to avoid carrying ballast in cargo tanks. This was replaced by the requirement that oil tankers delivered from 1996 onwards be fitted with double hulls (Pyc 2016). Thus, the protection of the marine environment

⁴⁷ <http://www.imo.org/en/OurWork/Environment/Pages/Default.aspx>

⁴⁸ <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/Pages/Default.aspx>

was significantly strengthened.⁴⁹

3.1.1.1. The double-hull tankers

The double hull design is a decisive improvement in the safety of oil tankers. Double hull tankers are vessels with an outer and an inner shell. If the outer shell is penetrated in a collision or grounding, the inner shell still prevents any escape of oil. According to regulation 19 of Annex I of the MARPOL Convention mentioned above, all new tankers must be built with a double hull. Existing tankers, built from 1996 onwards, must be built with a double hull, with transitional arrangements depending on the age and size of the ship (Chang and Danao 2017). US and EU ports have even stricter rules. Single-hull tankers have been banned from US ports since 1996 and from EU ports in 2010. Double-hull construction not only protects the marine environment, but also avoids pollution from cargo residues in normal ship operations. In an optimized tank layout, ballast tanks are configured to protect cargo tanks in the event of a collision.⁵⁰

3.1.2. MARPOL Annex II - Carriage of noxious liquid substances in bulk

The regulations governing the carriage of chemicals by ship are contained in the international SOLAS convention and the international MARPOL convention. Both conventions require chemical tankers built after 1 July 1986 to comply with the International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk (IBC). This code sets international standards for the safe carriage of hazardous chemicals and noxious liquids in bulk by sea. It also specifies the equipment that must be carried to minimize the risks to the ship, its crew and the environment, in terms of the nature of the products carried.

The Hazardous Liquid Bulk Pollution Control Regulations set out a pollution classification system for noxious and liquid substances. The four categories are:

⁴⁹ <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/OilPollution/Pages/Default.aspx>

⁵⁰ <https://www.deutsche-flagge.de/en/environmental-protection/marpol/oil>

- Category X: Noxious liquid substances which, if discharged into the sea from tank cleaning or leveling operations, are considered to present a significant risk to marine resources or human health and therefore justify a prohibition of discharge into the marine environment (Bueger 2015).
- Category Y: Noxious liquid substances which, if discharged into the sea from tank cleaning or leveling operations, are considered to endanger marine resources or human health or cause damage to facilities or other lawful uses of the sea and, therefore, justify a limitation on the quality and quantity of discharge into the marine environment.
- Category G: Noxious liquid substances which, if discharged into the sea from tank cleaning or tank blasting operations, are considered to present little risk to marine resources or human health and therefore warrant less stringent restrictions on quality and amount of discharge into the marine environment and
- Other substances: substances that have been assessed and found not to fall into category X, Y or Z because they are considered not to cause harm to marine resources, human health, amenity, or other legitimate uses of the sea when discharged into the sea from tank cleaning. It should be noted that the discharge of bilge or ballast water or other residues or mixtures containing these substances is not subject to any of the requirements of Annex II of MARPOL.

3.1.3. MARPOL Annex III - Chemical substances carried in packaged form

Chemicals carried in packaged, solid, or bulk form are regulated by SOLAS. MARPOL Annex III also sets out regulations for the prevention of pollution by harmful substances in packaged form and includes general requirements for issuing detailed specifications for packaging, marking, labelling, documentation, storage, quantity limitation, exemptions, and notifications for the prevention of pollution by harmful substances. For the purposes of Annex III, as "harmful substances" means those classified as "marine pollutants" in the International Maritime Dangerous Goods Code (IMDG) (Karim 2016) .

Both SOLAS and MARPOL refer to IMDG, which was developed by the IMO as a single international code for the carriage of dangerous goods by sea.⁵¹

3.1.4. MARPOL Annex IV - Prevention of pollution from sewage from ships

Annex IV contains a number of regulations relating to the discharge of sewage into the sea from ships, including regulations relating to ship sewage discharge control equipment and systems, the provision of port sewage reception facilities and requirements for survey and certification.

It is generally believed that in the open sea the oceans are capable of digesting raw sewage through natural bacterial action. Therefore, MARPOL Annex IV regulations prohibit the discharge of sewage into the sea within a specified distance from the nearest land, unless otherwise provided.

Governments are urged to ensure the provision of adequate reception facilities at ports and terminals to receive sewage without causing delay to ships.

The Annex entered into force on 27 September 2003. A revised Annex IV was adopted on 1 April 2004 and entered into force on 1 August 2005. The revised Annex applies to ships operating on international voyages of 400 gross tonnage and above or certified to carry more than 15 people. The annex requires ships to have either an approved sewage treatment facility or an approved dewatering and disinfection system or sewage storage tank (United Nations 2015).

3.1.5. MARPOL Annex V - Prevention of pollution from ship waste

Annex V of MARPOL aims to eliminate and reduce the amount of waste discharged into the sea by ships. Unless expressly provided otherwise, Annex V applies to all

⁵¹<http://www.imo.org/en/OurWork/Environment/PollutionPrevention/ChemicalPollution/Pages/Default.aspx>

ships, i.e. all ships of any type operating in the marine environment, from commercial vessels to fixed or floating platforms to non-commercial vessels such as pleasure craft.

Although the annex is optional, it received a large number of ratifications to enter into force on 31 December 1988. Today, more than 150 countries have signed MARPOL annex V. According to the annex, waste includes all types of food, household and functional waste, all plastics, cargo residues, cooking oil, etc.⁵²

3.1.5.1. Port waste reception facilities

The effectiveness of ships in complying with the discharge requirements of MARPOL is highly dependent on the availability of suitable port waste reception facilities. Therefore, MARPOL Annex V also obliges governments to ensure the provision of adequate reception facilities in ports and terminals to receive waste without causing undue delay to ships and in accordance with the needs of the ships using it.⁵³

3.1.5.2. Annex V special areas

These are marine areas where for recognized technical reasons related to their oceanographic and ecological status, such as low water exchange, extreme ice conditions, endangered marine species, etc. For this reason, the establishment of special mandatory methods for the prevention of marine pollution from garbage is necessary.

The special zones defined in Annex V are: the Mediterranean area, the Baltic Sea area, the Black Sea area, the Red Sea area, the Gulf of Aden, the North Sea area, the wider Caribbean area and the Antarctic region.

⁵² <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/Garbage/Pages/Default.aspx>

⁵³ http://www.marpoltraining.com/MMSKOREAN/MARPOL/Annex_V/r7.htm

3.1.5.3. Garbage management plan

All ships of 100 tonnes or more, every ship certified to carry at least 15 persons and every fixed or floating platform must carry on board a waste management plan, which includes written procedures for minimization, collection, storage, treatment and garbage disposal, including the use of equipment on board. The waste management plan must identify the person in charge of the plan and be written in the working language of the crew.

3.1.5.4. Garbage inventory book

The date, time, location of the ship, description of the waste and estimated quantity incinerated or disposed of must be recorded and signed. The litter register must be kept for a period of two years from the date of the last entry. This regulation does not impose stricter requirements - but it makes it easier to check compliance with waste regulations, as the ship's staff must monitor the waste and what happens to it.⁵⁴

3.1.6. MARPOL Annex VI - Prevention of air pollution from ships

Although air pollution from ships does not have the direct causes and effects associated with, for example, an oil spill incident, it contributes to the overall air quality problems faced by populations in many areas and also affects the natural environment, such as acid rain.

MARPOL Annex VI, first adopted in 1997, limits the main air pollutants contained in ships' exhaust gas, including SO_x and NO_x, and prohibits intentional emissions of Ozone Depleting Substances (ODS). Annex VI of MARPOL also regulates the incineration of ships and the emissions of volatile organic compounds (VOCs) from tankers. Following the entry into force of the Annex on 19 May 2005, the MEPC agreed to revise Annex VI of MARPOL with the aim of significantly strengthening emission limits.

⁵⁴ <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/Garbage/Pages/Default.aspx>

3.1.6.1. Revised Annex VI of MARPOL

The main changes in MARPOL Annex VI are the gradual global reduction of SO_x, NO_x and particulate emissions and the introduction of Emission Control Areas (ECAs) to further reduce these air pollutants in designated marine areas.⁵⁵ In these areas, stricter controls and conditions are imposed to reduce air pollution from ships. These conditions concern the control of the aforementioned pollutants, and their geographical limits are defined in Annex VI of MARPOL 1997. There are currently four ECAs:

1. the Baltic Sea,
2. the North Sea,
3. the North America Region and
4. the American coast of the Caribbean Sea.⁵⁶

Under the revised MARPOL Annex VI, the global maximum sulfur limit will be reduced from the current 3.50% to 0.50%, with effect from 1 January 2020, provided that the feasibility review is completed no later than in 2018.⁵⁷

3.1.6.2. Possible solutions for lower sulfur content

In maritime transport, heavy fuel oil (Heavy Fuel Oil – HFO) is still the most used fuel for ship engines. However, the required 0.10% sulfur content in the fuel cannot be achieved with HFO. Therefore, many shipping companies and charterers use low-Sulphur Marine Gas Oil (MGO).

Ships can alternatively run on HFO and MGO with a minor conversion of the engine installation. However, MGO is significantly more expensive than HFO. An alternative is to install scrubbers that remove sulfur oxides from the ship's engine and boiler exhaust.

⁵⁵ <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Air-Pollution.aspx>

⁵⁶ <https://www.isalos.net/2016/04/enas-odigos-gia-tis-emission-control-areas-ecas/>

⁵⁷ <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Air-Pollution.aspx>

Another solution to comply with the low sulfur requirement is to run with Liquefied natural gas (LNG) as fuel. LNG is natural gas cooled to -162 ° Celsius, which is then available in liquid form. The entire engine production plant must be equipped to use LNG, which is clearly cleaner than conventional fuels. Shipping industry experts expect increased use of LNG in maritime transport in the medium and long term.⁵⁸

3.2. Energy efficiency of ships

Subsequently, the IMO has adopted measures to increase energy efficiency and reduce greenhouse gas emissions from international shipping, leading to smooth implementation of the EEDI and SEEMP regulations by administrations and industry.

The expected growth of world trade is a challenge as mentioned in section 2.4.2. to achieve a future target for emissions needed to achieve stabilization in global temperatures and so the IMO began to consider further technical and operational measures to improve the energy efficiency of ships⁵⁹ which are presented below.

3.2.1. Energy Efficiency Design Index (EEDI)

The EEDI for new ships is the most important technical measure and aims to promote the use of more energy efficient (less polluting) equipment and engines. EEDI is a non-prescriptive, performance-based mechanism that leaves the choice of technologies to be used in a particular ship design. As long as the required level of energy efficiency is achieved, shipowners and shipbuilders are free to use the most cost-effective solutions to comply with regulations.

3.2.2. Ship Energy Efficiency Management Plan (SEEMP) and Operational Energy Efficiency Indicator (EEOI)

The SEEMP is an operational measure that establishes a mechanism to improve the

⁵⁸ <https://www.deutsche-flagge.de/en/environmental-protection/marpol/air-and-energy>

⁵⁹ <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Default.aspx>

energy efficiency of a ship in a cost-effective manner. This also provides an approach for shipping companies to manage ship performance over time, using for example the Energy Efficiency Operational Indicator (EEOI) as a monitoring tool. EEOI allows operators to measure fuel efficiency and the effects of any changes in operation, e.g. improved trip design or more frequent propeller cleaning or introduction of technical measures such as heat recovery systems or new propellers. SEEMP urges the shipowner and operator to consider new technologies and practices when seeking to optimize a ship's performance.

The adoption of mandatory reduction measures for all ships by the IMO in 2013 onwards has led to significant emission reductions and also a significant cost saving for the shipping industry. Up to 200 million tonnes of annual CO₂ reductions are estimated by 2020 from the introduction of EEDI for new ships and SEEMP for all ships.

The amendments to MARPOL Annex VI, which make energy efficiency standards mandatory, are the first international climate change treaty provisions to be formally adopted since the Kyoto Protocol in 1997. This includes the necessary steps to address the long-term of climate change caused by the increase in anthropogenic greenhouse gas emissions.⁶⁰

3.2.3. Reduction of greenhouse gas emissions from ships

As already recognized by the Kyoto Protocol, CO₂ emissions from international shipping cannot be attributed to any specific national economy due to its global nature and complex operation. Therefore, IMO has actively pursued the limitation and reduction of GHGs from international shipping, in recognition of the magnitude of the climate change challenge and the intense focus on this issue.⁶¹

The MEPC paid close attention to the control of GHGs from ships and finalized in

⁶⁰ <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Technical-and-Operational-Measures.aspx>

⁶¹ <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Default.aspx>

July 2009 a set of specific technical and operational reduction measures.⁶² Some of these measures are the use of alternative fuels in ships, biofuels, and the complementary use of natural or synthetic fuels such as ammonia, hydrogen and methanol. Also, another option is the use of technological innovations during the shipbuilding or retrofitting process, such as some improvements in the design of the ship's hull and the installation of a bulbous bow. Also, improvements in the operation of ships, such as reducing their speed limit, may contribute to the reduction of GHGs.⁶³

3.3. Ballast Water Management

Since the introduction of steel ships, water has been used as ballast to stabilize ships at sea. Ballast water is pumped to maintain safe operating conditions during a voyage.

While ballast water is essential for safe and efficient modern shipping operations, it can cause serious ecological, economic and health problems due to the multitude of marine species carried in ships' ballast. These include bacteria, microbes, small invertebrates, eggs, and larvae of various species. Transplanted species can survive to establish a breeding population in the host environment, becoming invasive, outcrossing native species, and multiplying to pest proportions. The consequences in many areas of the world have been devastating.

3.3.1. The global response to combating bio-invaders

The United Nations Convention on the Law of the Sea provides the global framework by requiring states to cooperate to prevent, reduce and control pollution of the marine environment, including the intentional or accidental introduction of species, alien or new to the marine environment, which can cause significant and harmful changes in it.

⁶² <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/GHG-Emissions.aspx>

⁶³ <https://www.isalos.net/2018/03/tropoi-gia-ti-meiosi-ton-ekpompon-aerion-rypon-apo-ta-ploia/>

The IMO has undertaken to address the transport of bio-invasive or otherwise invasive species through shipping. After 14 years of complex negotiations between IMO member states, an international convention for the control and management of ship ballast water and sediments (Ballast Water Management – BWM) was adopted by consensus. The convention requires all ships to implement a ballast water management plan and logbook.

3.3.2. Approval of ballast water management systems

During the development process of the Convention, considerable efforts were made to formulate appropriate standards for ballast water management. These are the exchange standard and the ballast water yield standard. Ships performing ballast water exchange must do so with a volumetric exchange efficiency of 95% of the ballast water and ships using a choke management system must meet a performance standard based on agreed numbers of organisms per unit volume.

According to Regulation D-3 of the BWM Convention, ballast water management systems used to comply with the Convention must be approved by the Administration. The regulation also provides that ballast water management systems using the active substances (G9) to comply with the convention will be approved by the IMO. He will ensure that the ballast water management system does not create excessive risks to the environment, human health, property or resources.⁶⁴

3.4. Antipollution systems

Antifouling paints are used to coat the bottoms of ships to prevent some marine life such as algae and mollusks from attaching to the hull which slows down the ship and increases fuel consumption.

In the early days of sailing ships lime and arginine were used to coat the hulls of ships until the modern chemical industry developed effective antifouling paints with metallic compounds. These compounds slowly leach into the seawater, killing marine

⁶⁴ <http://www.imo.org/en/OurWork/Environment/BallastWaterManagement/Pages/Default.aspx>

life attached to the ship. However, studies have shown that these compounds remain in the water, kill marine animals, damage the environment, and potentially invade the food chain.

The harmful environmental effects of organotin compounds (TBT) were recognized by the IMO in 1989. In 1990 the MEPC adopted a resolution recommending that governments take measures to eliminate the use of TBT-containing antifouling paints on vessels.

In November 1999, the IMO adopted an Assembly resolution calling on the MEPC to develop a legally binding worldwide instrument to address the harmful effects of antifouling systems used on ships. The resolution called for the establishment of a global ban on the application of TBTs acting as biocides in anti-fouling systems on ships by 1 January 2003 and a complete ban by 1 January 2008. This instrument was later adopted as the International Convention for the Control of harmful antifouling systems on ships.

The International Convention for the Control of Harmful Antifouling Systems on Ships banned the use of TBT in antifouling paints used on ships and created a mechanism to prevent the possible future use of other harmful substances in antifouling systems. The contract entered into force on September 17, 2008.

Under the terms of the convention, the contracting parties are required to prohibit or restrict the use of harmful anti-pollution systems on ships flying their flag, as well as ships not entitled to fly their flag, but operating under their authority and all ships entering a port, shipyard, or offshore terminal of a Contracting Party⁶⁵.

3.5. Ship recycling - Development of the Hong Kong Convention

The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships was adopted at a diplomatic conference held in Hong Kong, China

⁶⁵ <http://www.imo.org/en/OurWork/Environment/AntifoulingSystems/Pages/Default.aspx>

from 11 to 15 May 2009, attended by representatives of 63 countries. The convention aims to ensure that ships, when recycled at the end of their operational life, do not pose unnecessary risks to human health, safety and the environment.

The Hong Kong Convention aims to address all issues surrounding ship recycling, including the fact that ships sold for scrapping may contain substances that are hazardous to the environment, such as asbestos, heavy metals, hydrocarbons, ozone depleting substances and others. It also addresses concerns raised about working conditions and the environment in many of the global ship recycling areas.

The regulations in the convention cover: the design, construction, operation and preparation of ships to facilitate safe and environmentally sound recycling without compromising the safety and operational efficiency of ships.

With the entry into force of the Hong Kong Convention, ships sent for recycling will have to carry a list of hazardous materials, which will be specific to each ship. One part of the Convention provides a list of hazardous materials, the installation or use of which is prohibited or restricted in the shipyards of the contracting parties to the convention. Ships will be required to conduct an initial survey to verify the inventory of hazardous materials, additional surveys during the life of the ship and a final survey prior to recycling.

Ship recycling yards will be required to provide a "ship recycling plan", setting out how each ship will be recycled, depending on its particulars and inventory. Contracting Parties should take effective measures to ensure that ship recycling facilities under their jurisdiction comply with the Convention.⁶⁶

⁶⁶ <http://www.imo.org/en/OurWork/Environment/ShipRecycling/Pages/Default.aspx>

Chapter 4. The contribution of shipping to economic development and social justice

As mentioned in chapter 3 shipping contributes significantly to environmental protection through various regulations and measures. However, shipping is an industry that contributes equally to two other important factors, those of economic development and social justice. First, reference will be made to economic development. More specifically, approximately four-fifths of international trade is conducted by sea. Of course, the role of maritime transport for economic development and the work it performs was not always so important. In particular, after the use of iron and steel as a material for the construction of ships and thanks to the simultaneous development of mechanical means of propulsion, the mass transport of bulk cargo (raw materials, food, fuel) became possible and economically advantageous, on which the operation of the modern economy and with which the formation of global prices for basic goods was achieved.

International sea trade has turned out to be a huge economic mechanism, from the smooth operation of which depends not only the economic life of nations, but also the very existence of millions of people, since basic foodstuffs are among the most important objects of international maritime transport.⁶⁷ For this reason, shipping will remain the most important mode of transport for international trade⁶⁸.

Of course, apart from the contribution of shipping to economic development as mentioned above, we must talk about its contribution to social justice and more specifically to the employment of seafarers. An estimated 90% of the world's trade is carried by ships and this is done with the help of seafarers through the execution of voyages around the world and the further work they offer either on ships or in ports. Seafarers are in this respect essential to international trade. In fact shipping and seafaring are among the first globalized industries⁶⁹. The global population of

⁶⁷ El Georgandopoulos-G.P. Vlachos, Maritime Economics, Publications 'J.J. HELLAS', Piraeus 1997, p. 37

⁶⁸ <http://unctad.org/en/pages/PublicationWebflyer.aspx?publicationid=1890>

⁶⁹ <https://www.ilo.org/global/standards/subjects-covered-by-international-labour-standards/seafarers/lang--en/index.htm>

seafarers serving international merchant vessels is estimated at 1,647,500 seafarers⁷⁰.

4.1. The contribution of shipping to global economic development

The shipping industry is still largely determined by developments in the global economy and trade. Although the relationship between economic output and trade appears to be shifting according to Figure 1, with an observed decrease in the growth rate of trade to Gross Domestic Product (GDP) in recent years, the demand for maritime transport services remains highly dependent on the performance of the global economy.

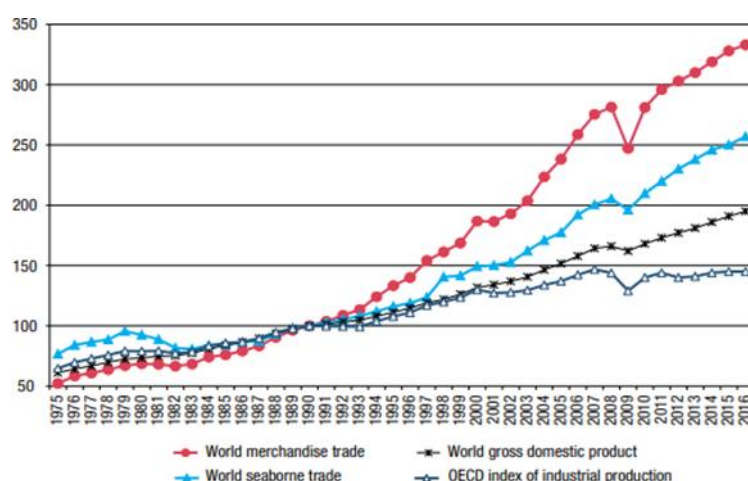


Figure 1 Indicators of industrial production.

Source: UNCTAD secretariat calculations, based on data from OECD, 2017; United Nations, 2017; UNCTAD Review of Maritime Transport, various issues; World Trade Organization, 2012

Note: Index calculations are based on GDP and trade transactions in dollars and maritime trade in metric tons.

While industrial activity, economic output, trade and maritime freight may grow at different rates, these variables nevertheless remain positively correlated for factors related to the Organization for Economic Co-operation and Development's index of industrial production. for Economic Cooperation and Development index- OECD) and with the global indices.

⁷⁰ <http://www.ics-shipping.org/shipping-facts/shipping-and-world-trade/global-supply-and-demand-for-seafarers>

Global economic growth slowed in 2016 with GDP growing at 2.2%, down from 2.6% in 2015 and below the 2001-2008 average annual growth rate of 3.2%. Factors that led to this shift include a weak global investment environment, limited global trade growth, increased trade policy uncertainty and the continued negative impact of low commodity price levels on both investment and country exports that export primary products.

Economic output in advanced economies also fell from 2.2% in 2015 to 1.7% in 2016, reflecting slower growth in the European Union by 1.9%, the United States by 1.6% and Japan by 1.0%. In developing economies, GDP growth slowed to 3.6%, down from 3.8% in 2015. Despite solid GDP growth of 6.7% supported by government stimulus measures introduced during the year, China continued to its gradual transition to a consumption-driven economy fueled by its own internal growth. In India, strong GDP growth of 7% continued but at a slightly slower pace than in 2015.

In the least developed countries, the GDP growth rate expanded by 3.7% in 2016, a rate well below the growth target of at least 7% which was set in the context of the sustainable development goals, namely goal 8 where it was mentioned in chapter 1.3 for promoting sustainable, inclusive and sustainable economic growth, full and productive employment and decent work for all⁷¹.

4.1.1. The contribution of maritime transport to the economy by type of cargo

4.1.1.1 Transportation of maritime trade by tankers

It should be emphasized that oil and its derivatives have become the most important source of energy in the world since the mid-1950s. Its products support modern society, primarily powering the electricity industry, heating homes, and fueling vehicles and airplanes to transport goods and people around the world⁷².

⁷¹ http://unctad.org/en/PublicationsLibrary/rmt2017_en.pdf

⁷² <http://www.ukogplc.com/page.php?pID=74>

In 2016, global tanker trade in crude oil, refined petroleum products and natural gas continued to grow on the back of an oversupplied oil market and low oil prices. Total volumes amounted to 3.1 billion tonnes, reflecting an increase of 4.2% on the previous year. The positive trends were supported by strong demand for crude oil imports in China, India and the United States and a high level of exported petroleum products from China and India.

Supported by steady import demand in China, India and the United States for the second consecutive year, crude oil shipments expanded by 4.3% in 2016 to an estimated total volume of 1.8 billion tonnes.

In addition, refined petroleum products and natural gas trade volumes expanded by 4%, taking total shipments to 1.2 billion tonnes in 2016. Demand for refined petroleum products was generally supported by a low oil price environment, with growth due to increased exports from West Asia, China and India, as well as a recovery in European import demand. While demand for refined petroleum products increased in China, India and the United States, weak economic growth in Japan and growth in the Americas, however, limited global imports of refined petroleum products. Volumes were supported by stronger demand for gasoline, while demand for diesel declined due to weak global industrial activity. Only India, the Republic of Korea and Europe saw strong increases in oil demand, mainly for transportation. In terms of natural gas trade, LNG shipments are estimated to have expanded by 7.2% in 2016, with shipments reaching 268 million tons. The expansion led to increased exports from Australia and the United States contributing significantly to the economic growth of the two countries. Import volumes to China, India and other developing economies in Asia, particularly in West Asia, have been growing steadily. These positive developments helped offset declines in the import volumes of the Republic of Korea and Japan⁷³.

⁷³ http://unctad.org/en/PublicationsLibrary/rmt2017_en.pdf

4.1.1.2. Transport of dry bulk cargo

Shipping contributes significantly to the transport of basic raw materials. For example, the vast amount of grain required to make the world's daily bread could not be transported by any other means than by ship⁷⁴.

In 2016, global demand for dry bulk cargoes grew at a moderate rate of 1.3%. According to dry bulk, trade in the most basic bulks increased by 1.6%. Iron ore trade showed the strongest growth as it expanded by 3.4% to reach 1.4 billion tonnes in 2016. Imports into China rose more than 7% reflecting the growth of steel production in the country, the decline in domestic production iron ore, increasing storage activity and access to affordable high quality iron ore from Australia and Brazil.

Coal trade declined in 2016. A marginal increase in coal volumes reflected higher import demand in China and Japan. These were offset by lower import volumes in India, the Republic of Korea and Europe. Declines in thermal coal imports in India, Japan, the Republic of Korea and Europe were offset by a 4% percentage increase in imports from other Asian countries, notably China, where import volumes increased by more than 28% contributing significantly to economic development.

Cereals trade grew by 3.7% in 2016 as EU imports surged due to poor harvests in some producing countries. In China, grain imports fell as the government decided to promote the use of local grain stocks to support local farmers. Also, demand for imports in the United States eased due to strong domestic production, while Brazil increased exports of corn and soybeans. However, trade in some other small bulk products such as cement, petroleum coke and sugar was positive and helped slightly offset the decline in shipments of nickel and bauxite.

In conclusion, for the movement of many goods, the most ideal mode of transport is that of shipping⁷⁵. Sea transport is the least expensive way of transporting goods and

⁷⁴ <http://www.ics-shipping.org/docs/default-source/resources/policy-tools/sustainable-development-imo-world-maritime-day-2013.pdf?sfvrsn=18>

⁷⁵ <https://ramiwaheed.wordpress.com/2012/09/15/the-economic-role-of-the-shipping-industry/>

can transport products all over the world⁷⁶. It is obvious that maritime trade is now an artery, the interruption of which is capable of bringing about the collapse of the economic life of the planet. Maritime transport can substitute for road and rail transport, depending on cost, time and infrastructure constraints⁷⁷.

4.2. The contribution of shipping to social justice

The global population of seafarers serving international merchant vessels is estimated at 1,647,500 seafarers. China, the Philippines, Indonesia, the Russian Federation and Ukraine are estimated to be the top five countries of origin of seafarers⁷⁸. The highest priority of the international shipping industry remains the safety of life at sea⁷⁹.

In order to protect the world's seafarers and their contribution to international trade, the ILO has adopted Conventions and related recommendations. The ILO's international standards in this area set out the minimum conditions for "decent work" on board a ship (such as minimum age, medical fitness and education), hours of work and rest, wages, leave, repatriation, housing, recreational facilities, food and catering, safety and security at work, medical care, social welfare and social protection⁸⁰.

Below will be mentioned contracts related to seafarers' working conditions on ships.

4.2.1. The Maritime Labor Convention (MLC)

The 2006 MLC is an international ILO agreement that sets out the rights of seafarers to decent working conditions. Sometimes called the Seamen's Bill of Rights. It applies to all seafarers, including those working in hotel and other passenger services on cruise ships and commercial vessels. In 2013, the MLC became binding law for 30

⁷⁶ <https://www.inc.com/encyclopedia/transportation.html>

⁷⁷ El Georgandopoulos-G.P. Vlachos Shipping Economics, Publications 'J.J. HELLAS', Piraeus 1997, p. 37

⁷⁸ <http://www.ics-shipping.org/shipping-facts/shipping-and-world-trade/global-supply-and-demand-for-seafarers>

⁷⁹ <http://www.ics-shipping.org/docs/default-source/resources/policy-tools/sustainable-development-imo-world-maritime-day-2013.pdf?sfvrsn=18>

⁸⁰ <https://www.ilo.org/global/standards/subjects-covered-by-international-labour-standards/seafarers/lang--en/index.htm>

countries. Also, as of July 2017, a total of 84 countries had ratified the 2006 MLC, which resulted in over 90% of the global shipping fleet being regulated⁸¹.

Nearly 1.2 million seafarers will be affected by the terms and conditions of this human rights convention, which will establish a set of regulations on safety at work, living conditions, employment, health, social security, and similar related matters.

In addition, flag states will accordingly issue the MLC certificate to their flagged fleet, surveys, inspections, paperwork, and approvals. The certificate should then be posted in a conspicuous place on board.

4.2.1.1. The MLC Content, 2006

First, it includes the minimum requirements that seafarers working on ships must have, such as minimum age, possession of a medical certificate, necessary training and certifications. Also, the MLC contains the terms of employment i.e. the seafarer's contract of employment, wages, rest and working hours, leave entitlement and repatriation of seafarers. Also, it includes their accommodation, recreation, food and catering. In addition, MLC incorporates health protection, medical care, welfare and social security protection such as medical care on board and ashore, health and safety protection, accident prevention and, access to facilities land-based welfare. Finally, the last requirement included in the MLC is compliance and enforcement in the regulations, ie, in the flag state, in the maritime labor certificate as well as in the procedures on board, in the Competent Authorities of the port state and in marine accidents.

4.2.1.2. Validity of the certificate

The MLC certificate may be issued for a period not exceeding five (5) years, after a thorough inspection and verification that the vessels meet the minimum requirements of the MLC. To ensure that ships flying the flag of Member States continue to comply with the requirements and standards of the Convention, the competent flag authority

⁸¹ <https://seafarersrights.org/seafarers-subjects/maritime-labour-convention-mlc/>

may renew the certificate and keep a public record of the same. Newly built ships and ships undergoing a change of flag shall also issue the certificate on a temporary basis for periods not exceeding six (6) months.

4.2.1.3. Survey requirements and port state control

Port State control has the right to board any vessel at any given time to verify compliance with the MLC. However, port state control inspectors have the right to detain a vessel that does not comply with the requirements of the MLC. Finally, MLC, 2006 is a milestone for the global shipping industry. Its implementation enhances the lives of seafarers working on the high seas, while increasing the safety and insurance of marine vessels⁸².

4.2.2. The STCW Convention

STCW concerns the standards of training, certification and custody of seafarers which was approved on July 7, 1978 and entered into force on April 28, 1984. It is a global convention that ensures the achievement of a standard of training in all countries of the world⁸³. The convention promotes the safety of life and property at sea and provides for further measures to protect the marine environment⁸⁴.

States under the STCW are obliged to issue laws, decrees, circulars and regulations and take measures to fully implement the convention to ensure that seafarers on board ships are qualified and competent to perform their duties⁸⁵.

Prior to STCW the standards of training, certification and compliance of prison officers and ratings were determined by individual governments. As a result, standards and procedures varied widely, even though shipping is the most international of all industries⁸⁶. Next, the two amendments to STCW will be

⁸² <https://www.marineinsight.com/maritime-law/a-guide-to-maritime-labour-convention-mlc-2006-for-maritime-professionals/>

⁸³ <https://www.stcwdirect.com/stcw-training/>

⁸⁴ https://www.seaschool.com/course_details.php?cid=stcw

⁸⁵ Hellenic Association for the Protection of the Marine Environment, STCW and seafarers, Athens September 1991, p. 1

⁸⁶ <http://www.imo.org/en/About/conventions/listofconventions/pages/international-convention-on->

mentioned for its better and more effective implementation.

4.2.2.1. First major revision of STCW - 1995

Initially, STCW was amended in 1995 and entered into force on 1 February 1997. One of the main features of the revision was the division of the technical annex into regulations, divided into chapters, and a new STCW code, into which many technical regulations were transferred. Part A of the Code is mandatory and details in a series of tables the minimum standards of competence required for seafarers, while Part B is recommended. Part B of the Code contains proposed guidelines intended to assist Parties to implement the Convention. The proposed measures are not mandatory. However, the recommendations generally represent an approach that has been harmonized with discussions within the IMO and consultations with other international organizations. Separating regulations in this way facilitates administration and makes reviewing and updating them simpler.

Another important change was the requirement for the parties to the convention to provide detailed information to the IMO about the administrative measures taken to ensure compliance with the convention, education and training courses, certification procedures and other factors relevant to implementation. This is the first time the IMO has been called upon to act in relation to compliance and enforcement. Generally, implementation is done in flag states, while port state control also ensures compliance⁸⁷.

4.2.2.2. Second major revision of STCW - 2010

In June 2010, major changes to the STCW Convention and Code were agreed at an IMO Diplomatic Conference in Manila in order to update the Convention and Code with new developments to address the issues expected to arise in the near future. These changes, known as the “Manila Amendments to the STCW Convention and Code”, entered into force on 1 January 2012 and are the first major revisions since the

[standards-of-training,-certification-and-watchkeeping-for-seafarers-\(stcw\).aspx](#)

⁸⁷ https://www.dco.uscg.mil/Portals/9/NMC/pdfs/stcw/stcw_history_implementation_and_structure.pdf

Convention and Code were amended in 1995⁸⁸. They should stressed, that it is necessary for contracts to be amended from time to time to deal with new technologies, strict environmental and safety policies and the improvement of the current system⁸⁹.

Below are some important changes to each chapter of the Convention and the Code, including:

- Improved measures to prevent fraudulent acts related to certificates of competence and strengthen the assessment process.
- Revised requirements regarding hours of work and rest and new requirements to prevent drug and alcohol abuse, as well as updated standards regarding seafarers' standards of medical care.
- New certification requirements for competent seafarers.
- New training requirements in modern technology such as Electronic Chart Display and Information Systems (ECDIS).
- New requirements for marine awareness education and training in leadership and teamwork.
- Update of proficiency requirements for personnel servicing all types of tankers, including new requirements for personnel servicing LPG tankers.
- Introduction of modern training methodology, including distance education and online learning.
- New training guidelines for personnel servicing ships operating in polar waters and
- New training instructions for personnel operating dynamic positioning systems⁹⁰.

In this day and age, prospective seafarers must undergo basic training in relation to STCW in order to be issued with a certificate attesting that they have received safety training and are therefore competent to board a seagoing vessel. Prison training, certification and compliance rules or standards are considered strict.

⁸⁸ <http://navis-odessa.com/articles/stcw-manila-amendments-to-the-stcw-convention-and-code>

⁸⁹ <https://www.marineinsight.com/maritime-law/stcw-2010-manila-amendments-change-or-no-change/>

⁹⁰ <http://www.imo.org/en/OurWork/HumanElement/TrainingCertification/Pages/STCW-Convention.aspx>

However, despite this strict measure and rigorous training that a seafarer has undergone before being granted a certificate, it will prove to be really beneficial. Through these trainings, the future seafarer will know the different dangers that he may be involved in or the dangers that he may face. In this way, they will realize that the shipping industry carries many risks. In this STCW training, they will be trained in the basics of firefighting, first aid, personal survival techniques, safety and social responsibility. Finally, through these training, certification and prison compliance standards, there will be an improvement in the standards of the ports, the seafarers produced and the shipping industry as a whole⁹¹.

Chapter 5. Conclusions

The Sustainable Development Goals set by the United Nations for 2030 tend to meet the basic needs of humans for survival but, at the same time, try to provide them with the best possible standard of living. However, in order to cover its material or immaterial needs, a necessary condition is to ensure a healthy environment through the reduction and subsequent elimination of climate change.

Sustainable Development is an action that concerns all states. For this, it is necessary that everyone contributes to the achievement of the goals set by the United Nations. Thus, Greece also actively participates in the defense of the goals through Training Programs. The purpose of these programs is the training of the state agencies regarding the modern social, economic and environmental dimensions of Sustainable Development, as they are reflected mainly in the 2030 Agenda and the UN goals.

The concept of Sustainable shipping seems to be the focus of both the states and the shipping agencies involved. Its vision has been achieved to some extent through International Organizations and Conventions but also through development policies that improve technology and promote sustainability in shipping. More specifically, shipping should switch to renewable energy sources and in this way will limit the use of fuel oil and indirectly reduce emissions that are harmful to the environment.

⁹¹ <http://www.stcwonline.com/uncategorized/the-stcw-and-why-it-is-so-important-to-mariners>

However, no carbon-free fuels are available today. For this, research and development efforts are necessary, not only to formulate such fuels, but also to make them available for the movement of ships. In addition to developing carbon-free fuels the IMO will need to develop new policy, measures and regulations to implement its ambitious strategy. It is necessary to strengthen the EEDI index and reduce the speed of ships.

The shipping industry should in the coming years invest hundreds of billions of dollars in environmentally sustainable technologies that will contribute to the elimination of climate change as it is a matter of primary importance that concerns humanity of the entire planet. Of course, these technologies should always be guided by what the International Maritime Organization foresees.

In addition, maintaining economic viability is essential because shipping carries approximately 90% of world trade. Without its existence, goods of primary importance to man cannot be transported.

Finally, shipping seems to employ a large number of seafarers and is expected to grow more and more in the future as it is an industry with a constant demand for sea transport. Of course, at this point it should be emphasized that shipping takes care of the working conditions and safety of seafarers through the establishment and implementation of various Conventions and Regulations that defend their rights.

References

Greek Bibliography

Ελ Γεωργαντόπουλος-Γ.Π. Βλάχος, Ναυτιλιακή Οικονομική, Εκδόσεις 'J.J. HELLAS', Πειραιάς 1997

Ελληνική Ένωση Προστασίας Θαλάσσιου Περιβάλλοντος, STCW και ναυτικοί, Αθήνα Σεπτέμβριος 1991, σελ. 1

Καρβούνης Σωτ-Γεωργακέλλος Δημ (2003), Διαχείριση του Περιβάλλοντος εκδόσεις Αθ. Σταμούλης, σελ 218

Foreign Language Bibliography

Alan Boyle – David Freestone, International Law and Sustainable Development – Past Achievements and Future Challenges, Oxford University Press, 1999, pp. 22-23.j

Allal, Abdelmoula Ait, Khalifa Mansouri, Mohamed Youssfi, and Mohammed Qbadou. 2018. Toward a Study of Environmental Impact of Shipping Industry and Proposal of Alternative Solutions. In International Conference on Advanced Intelligent Systems for Sustainable Development. Cham: Springer.

Benamara et al. Maritime transport: the sustainability imperative

Bueger, Christian. 2015. What is maritime security? Marine Policy 53: 159–64.

Chang, Young-Tae, and Denise Danao. 2017. Green shipping practices of shipping firms. Sustainability 9: 829.

Cormier et al. SMART marine goals, targets and management - Is SDG 14 operational or aspirational, is 'Life Below Water' sinking or swimming? Maritime Pollut. Bull. (2017)

Edwards, Miguel. 1993. How Relevant Is Development Studies. Beyond the Impasse: New Directions in Development Theory. London: Zed Books, pp. 77–91.

Fleming et al. The sustainable development goals: A case study Mar. Policy (2017)

Islam et al. Coastal and marine conservation strategy for Bangladesh in the context of achieving blue growth and sustainable development goals (SDGs) Environ. Sci. Policy (2018)

Ntona et al. Connecting SDG 14 with the other sustainable development goals through marine spatial planning Mar. Policy (2018)

Okafor-Yarwood Illegal, unreported and unregulated fishing, and the complexities of

the sustainable development goals (SDGs) for countries in the Gulf of Guinea Mar. Policy (2019)

Pedersen, Claus Stig. 2018. The UN sustainable development goals (SDGs) are a great gift to business! *Procedia CIRP* 69: 21–24.

Psaraftis, Harilaos N. 2019. *Sustainable Shipping*. Berlin: Springer International Publishing.

Pyć, D. 2016. Global ocean governance. *TransNav: International Journal on Marine Navigation and Safety of Sea Transportation*.

Recuero Virto A preliminary assessment of the indicators for Sustainable Development Goal (SDG) 14 “Conserve and sustainably use the oceans, seas and marine resources for sustainable development” *Mar. Policy* (2018)

Ringbom, Henrik. 2018. Regulation of ship-source pollution in the Baltic Sea. *Marine Policy* 98: 246–54.

Singh et al. A rapid assessment of co-benefits and trade-offs among sustainable development goals *Mar. Policy* (2018)

Spalding, Mark J. 2016. The new blue economy: The future of sustainability. *Journal of Ocean and Coastal Economics* 2: 8.

United Nations. 2015. *Transforming Our World: The 2030 Agenda for Sustainable Development*. Available online:

<https://sustainabledevelopment.un.org/post2015/transformingourworld>

Online Resources

<https://www.kemel.gr/articles/viosimi-anaptyxi>

<http://www.un-documents.net/our-common-future.pdf>.

<https://wegogreen.gr/info-material/before-recycling/>

<https://sustainabilityadvantage.com/2010/07/20/3-sustainability-models>

<http://www.thwink.org/sustain/glossary/ThreePillarsOfSustainability.htm>

<https://i0.wp.com/sustainabilityadvantage.com/wp-content/uploads/2010/07/Blog-07-20-10-Slide-3.jpg>

<https://i2.wp.com/sustainabilityadvantage.com/wp-content/uploads/2010/07/Blog-07-20-10-Slide-4.jpg>

http://www.europedia.moussis.eu/books/Book_2/2/2/3/?lang=gr&all=1&s=1&e=10

https://ec.europa.eu/info/strategy/international-strategies/global-topics/sustainable-development-goals/eu-approach-sustainable-development_el

<https://www.un.org/sustainabledevelopment/poverty/>

<https://www.un.org/sustainabledevelopment/hunger/>

<https://www.un.org/sustainabledevelopment/health/>

<https://www.un.org/sustainabledevelopment/education/>

<https://www.un.org/sustainabledevelopment/gender-equality/>

<https://www.un.org/sustainabledevelopment/water-and-sanitation/>

<https://www.un.org/sustainabledevelopment/energy/>

<https://www.un.org/sustainabledevelopment/economic-growth/>

<https://www.un.org/sustainabledevelopment/infrastructure-industrialization/>
(4/8/2018) <https://www.un.org/sustainabledevelopment/inequality/>

<https://www.un.org/sustainabledevelopment/cities/>

<https://www.un.org/sustainabledevelopment/sustainable-consumption-production/>

<https://www.un.org/sustainabledevelopment/climate-change-2/>

<https://www.un.org/sustainabledevelopment/oceans/>

<https://www.un.org/sustainabledevelopment/biodiversity/>

<https://www.un.org/sustainabledevelopment/peace-justice/>

<https://www.un.org/sustainabledevelopment/globalpartnerships/>

<https://eur-lex.europa.eu/legal-content/EL/TXT/?uri=LEGISSUM%3A132042>

https://www.tankonyvtar.hu/en/tartalom/tamop425/0032_kornyezetiranyitas_es_minosegbiztositas/ch04s02.html

<https://www.kullabs.com/classes/subjects/units/lessons/notes/note-detail/1182>

<https://www.rodiki.gr/article/45395/feroysa-ikanothta-kai-anaptyxh>

<http://www.imo.org/en/MediaCentre/HotTopics/Documents/IMO%20SDG%20Brochure.pdf>

<https://www.marinelink.com/news/implementing-sustainable427489>

<http://www.imo.org/en/MediaCentre/HotTopics/Documents/TC.1-Circ.69.pdf>

<http://www.emsa.europa.eu/about/faq/175-governance/343-is-emsa-a-competitor-to-the-international-maritime-organization-imo.html>

<http://www.emsa.europa.eu/about/what-we-do-main.html>

<http://emsa.europa.eu/main/sustainable-toolbox/relevant-eu-projects.html>

<https://www.ssi2040.org/>

<https://qz.com/59923/worlds-largest-container-ships-maersk-launch-2013/>

<https://www.slideshare.net/forum4thfuture/ssi-case-for-action-full-report>

<https://www.ship-technology.com/projects/triple-e-class/>

<https://safety4sea.com/slow-steaming-remains-priority-maersk/>

<https://www.kingkit.co.uk/product/merit-ships--4908-bp-tanker-ss-sovereign->

<http://www.intertanko.com/upload/virtualarrival/virtualarrivalinformationpaper.pdf>

<https://www.glassdoor.ca/Photos/Gearbulk-Office-Photos-IMG1077000.htm>

<https://www.gearbulk.com/>

<https://www.shipandoffshore.net/news/shipbuilding/shipbuilding-article/id/project-agreement-for-largest-kite-powered-vessel.html>

<https://www.cargill.com/transportation/dry-bulk-shipping>

<http://blog.naver.com/PostView.nhn?blogId=dsjang650628&logNo=220679243153>

<https://www.bp.com/en/global/bp-shipping.html>

<http://www.ics-shipping.org/docs/default-source/resources/policy-tools/sustainable-development-imo-world-maritime-day-2013.pdf?sfvrsn=18>

<http://www.imo.org/en/OurWork/Environment/Pages/Default.aspx>

<http://www.imo.org/en/OurWork/Environment/PollutionPrevention/Pages/Default.aspx>

<https://www.deutsche-flagge.de/en/environmental-protection/marpol/oil>

<http://www.imo.org/en/OurWork/Environment/PollutionPrevention/Garbage/Pages/D>

[ef ault.aspx](#)

http://www.marpoltraining.com/MMSKOREAN/MARPOL/Annex_V/r7.htm

<https://www.isalos.net/2016/04/enas-odigos-gia-tis-emission-control-areas-ecas/>

<https://www.deutsche-flagge.de/en/environmental-protection/marpol/air-and-energy>

<http://www.imo.org/en/OurWork/Environment/BallastWaterManagement/Pages/Default.aspx>

<http://www.imo.org/en/OurWork/Environment/AntifoulingSystems/Pages/Default.aspx>

<http://www.imo.org/en/OurWork/Environment/ShipRecycling/Pages/Default.aspx>

<http://unctad.org/en/pages/PublicationWebflyer.aspx?publicationid=1890>

<https://www.ilo.org/global/standards/subjects-covered-by-international-labour-standards/seafarers/lang--en/index.htm>

http://unctad.org/en/PublicationsLibrary/rmt2017_en.pdf

<http://www.ukogplc.com/page.php?pID=74>

<https://www.inc.com/encyclopedia/transportation.html>

<https://seafarersrights.org/seafarers-subjects/maritime-labour-convention-mlc/>

<https://www.marineinsight.com/maritime-law/a-guide-to-maritime-labour-convention-mlc-2006-for-maritime-professionals/>

<https://www.stewdirect.com/stcw-training/>

https://www.seaschool.com/course_details.php?cid=stcw

https://www.dco.uscg.mil/Portals/9/NMC/pdfs/stcw/stcw_history_implementation_and_structure.pdf

<https://www.marineinsight.com/maritime-law/stcw-2010-manila-amendments-change-or-no-change/>

<http://www.imo.org/en/OurWork/HumanElement/TrainingCertification/Pages/STCW-Convention.asp>