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The paradigm of sustainable development in maritime education and training

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THE PARADIGM
OF SUSTAINABLE DEVELOPMENT
IN MARITIME EDUCATION AND TRAINING

By

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(MARITIME EDUCATION AND TRAINNG)

2013

Declaration

I certify that all the materials in this dissertation that is my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

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

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11. 10. 2013

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Abstract

Title of Dissertation: **The Paradigm of Sustainable Development in Maritime Education and Training**

Degree: **MSc**

This dissertation is an inquiry into the application of the sustainable development paradigm in maritime education and training, extrapolating the pedagogical concept of education for sustainable development.

It takes a reader from the history of sustainable development and discussions concerning its definition to the application of sustainable development in the maritime industry. Also, the role of education in sustainable development is explored as well as the possibility to apply the concept of education for sustainable development in MET.

Selected challenges in the maritime industry are investigated along with speculations about the future demands of the international maritime labour market with the purpose to ensure that the proposed model of maritime education and training provides necessary competencies to mitigate existing challenges.

The reaction of MET institutions in regard to sustainable development is analysed. Recommendations are elaborated concerning incorporating sustainable development into MET with references to management and curriculum design.

The concluding chapter attempts to identify the conditions for successful implementation of the sustainable development paradigm in the maritime industry and MET.

KEYWORDS: sustainable development, maritime industry, education, curriculum, management.

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List of Abbreviations

Concept	The IMO Concept of a Sustainable Maritime Transport System
ESD	Education for Sustainable Development
IMO	International Maritime Organization
MET	Maritime education and training
RIO+20 Conference	The United Nations Conference on Sustainable Development, held in Rio de Janeiro, Brazil, June 2012
UN	United Nations Organization
UNESCO	United Nations Educational, Scientific and Cultural Organization
WMU	World Maritime University

1. Introduction

"We cannot solve our problems with
the same thinking we used to create them"
Albert Einstein

"Education is the most powerful weapon
you can use to change the world"
Nelson Mandela

1.1. Background and rationale

Oceans are an essential component of the biosphere. They provide not only balance for life-support systems such as climate and biodiversity but also a platform for human activities vital for progress, such as transportation of goods and people along with exploration and exploitation of marine resources. Inevitably, these human activities have resulted in an impact on the marine ecosystem due to the rapid pace of industrial economic growth firstly recognized in a series of United Nations' (UN) conferences held in the 1970s and 1980s.

In the following decades, the UN took a leading role in establishing institutional frameworks to develop action plans to tackle effectively emergent environmental and social concerns under the umbrella of the sustainable development paradigm.

Currently, the international community is working towards elaborating global solutions in accordance with the vision agreed in the United Nations Conference on Sustainable Development in Rio de Janeiro in 2012. This initiative echoed through all UN agencies, including IMO.

"Sustainable development: IMO's contribution beyond RIO+20" was announced as the World Maritime Day theme, 2013, calling Governments and the shipping industry to contribute towards formulating sustainable maritime development goals (IMO, 2013d). Initially IMO specified eight pillars around which sustainable maritime development goals should be set, and maritime education and training (MET) was stated as one of the goals. Accordingly, the interrelation issue between sustainable development and MET was raised, which is subsequently elaborated in this dissertation. This research on the sustainable development paradigm in MET is timely, as it was undertaken while IMO was drafting its own vision of sustainable maritime development. The focus of this study is relevant to the core activity of IMO as there is a need to discuss the role of MET in the scope of sustainable development.

1.2. Aim, objectives and outcomes of the research

The aim of the dissertation research is to analyse the interrelationship between sustainable development and MET, which leads to the elaboration of the following objectives:

- o discuss the current understanding of sustainable development and its application for the maritime industry;
- o demonstrate the role of education in proliferation of sustainable development and analyse the possibility to extrapolate the concept of education for sustainable development (ESD) in MET;
- o define challenges arisen in the maritime industry due to the sustainable maritime development;
- o examine needs for changes in MET caused by sustainable maritime development: curriculum, content of subjects, teaching/learning concepts, assessment processes; and
- o discuss the sustainable policy of MET institutions.

The dissertation research contributes to the theoretical knowledge about sustainable development, sustainable maritime development and the role of MET in their proliferation. Practically, outcomes of this research might be used for teaching purposes, future scientific research, defining goals of sustainable maritime development and actions to implement these goals, preparing policy documents in MET institutions related to sustainable development, designing, reviewing and evaluating MET programmes and courses, and selecting appropriate learning activities. The research contains an authentic analysis of the international instruments on sustainable development with determination of maritime and educational aspects (Appendix 2) and a sample curriculum for a course, Sustainable Maritime Development (Appendix 6).

1.3. Methodology and literature review

The dissertation research was accomplished using traditional scientific methods such as mind mapping, deduction, induction, extrapolation, envisioning, system thinking and complexity thinking. These methods were selected considering the aim and research objectives as well as literature availability. At the same time, the researcher acknowledges that the absence of perspectives of people on site as a limitation (Sampson, 2013). In this case, the experiences of seafarers, who are facing the issue of sustainable development in their everyday life should not be neglected. To ensure objective analysis of future demands for maritime professionals and to appreciate social conditions on board ships, the author visited four ships: two newly built container ships (18,000 and 8,000 TEU), and two environmentally friendly research vessels, one of which sails primarily under wind power. Additionally, the author spent 12 days on board of one of the research vessels.

The topic of this dissertation, the paradigm of sustainable development in MET, is conceptual and complex by nature and this may allow various interpretations based on one's knowledge and experience. In order to avoid such diversion from the facts,

the underlying principle in the research was Bertrand Russell's (1959) recommendation to future generations regarding intellectual work:

> "When you are studying any matter, or considering any philosophy, ask yourself only what are the facts and what is the truth that the facts bear out. Never let yourself be diverted either by what you wish to believe, or by what you think would have beneficent social effects if it were believed. But look only, and solely, at what are the facts".

The research begins to unpack a web of complex and entangled ideas around sustainable development and MET. Mind mapping, a visualization of information and associations between its components, was primarily used at the initial stage of the research (Appendix 1). Obtained outcomes were developed into research objectives and consequently shaped the content of the dissertation.

Whilst an extensive list of literature on sustainable development exists, the research faced a lack of literature relating to sustainable development in maritime contexts. Deductive-inductive reasoning was, therefore, applied to acquire additional knowledge about sustainable maritime development from the meaning of sustainable development. In this regard, principal international instruments on sustainable development were analysed with the purpose of identifying maritime aspects specifically and, thereby improving the existing understanding of sustainable maritime development, which is currently not conceptualized (Cabezas-Basurko et al., 2008; Svensson, 2012). A Profound theoretical inquiry into sustainable development (Fergus & Rowney, 2005; Kates et al., 2005; Lele, 1991), its historical advancement, (Dresner, 2008; Timoshenko, 1995; Voigt, 2009) and structure (Dresner, 2008; Scottish Executive Social Research, 2006) has enabled the formulation of an independent authorial viewpoint on emerging discussions concerning sustainable maritime development. In particular, deductive-inductive reasoning helped to clarify MET's role in sustainable maritime development through examining functions of ESD as well as relevant scientific publications of reputable authors (Cortese, 2003; Hopkins, 2012; Gadotti, 2010; Tilbury & Wortman, 2004; Sterling, 2003).

The research was initially designed to prepare a questionnaire for students of the World Maritime University (WMU) Master of Science programme aiming at evaluating their comprehension of sustainable maritime development and its relation to MET. The students of WMU are a group of maritime experts including government officials, administrative personnel, lawyers, seafarers and port authorities. Despite the author's expectation that it would provide a common understanding of the topic from such diverse maritime professionals, the results of this pilot survey demonstrated that students underestimate the connection between the sustainable development and MET and, therefore, answers provided on subsequent questions were not reliable. Consequently, in this research area, the author relied on data obtained during specially conducted surveys including Drewry Maritime Research (2012), Japan International Transport Institute (2010), KNOWME (2012), Shiptalk Recruitment Limited (2007) and applied scientific methods for its analysis.

Investigation into the interrelation between sustainable maritime development and MET revealed a lack of related research (Hanson, 2012; Krause et al., 1993; Torskiy & Topalov, 2007; Waters, 1993; Williamson, 1993). The majority of publications refer to sustainable development and sustainability in MET as the continuous supply of seafarers or financial perpetuation of MET institutions. However, these viewpoints considerably reduce the understanding of the sustainable development paradigm and disregard the ESD concept.

To eliminate these deficiencies, the author applied a method of extrapolation and extended achievements of the ESD concept to maritime educational establishments. To examine actual applications of sustainable practices in MET, a survey was accomplished through official web sites of 43 educational institutions.

Elaborating recommendations for improvement of MET, the author considered current and future challenges in the maritime industry in light of sustainable maritime development taking into account forecasts of reputable institutions

(BIMCO, BP, Drewry Maritime Research, UNCTAD) as well as relevant scientific publications (Forum for the Future, 2011).

As a matter of methodology, Morin's publications on complexity were analysed (Morin, 1992; Morin, 1999a) considering the fact that the sustainable development paradigm is inextricably linked to complexity. Sustainable development is not just a sum of environmental, social and economic components together with connections among them, but a "whole" new phenomenon with qualities unknown to its components. Therefore, the use of complexity thinking in research devoted to sustainable development is inevitable. Furthermore, the significance of education is stressed in Edgar Morin's monograph "Seven complex lessons in education for the future", in which the philosopher identified fundamental problems that are neglected in education and should be taught in the future (Morin, 1999b).

It is important to mention, that the present research was started shortly after the announcement of the World Maritime Day theme, 2013, and, therefore, was nearly completed just before the presentation of "Concept of a Sustainable Maritime Transport System" (IMO, 2013f). Despite the fact, that activities of the International Maritime Organization (IMO) dedicated to sustainable maritime development were attentively followed, research outcomes are not always in line with IMO's vision, which is indeed evidence of the originality of this study.

Above all, the literature review demonstrates the lack of uniform understanding of sustainable development, which is defined as paradigm (Gladwin et al., 1995; McKeown et al., 2002; Schuftan, 2003), concept (Jabareen, 2008; Kates et al., 2005), principle (UN, 1987), process (Gladwin et al., 1995), activity (Engel, 1990) or even type of society. Moreover, sustainable development is frequently confused with, antagonistic to its nature, principles of growth, perpetuation and financial stability. According to the philosophy of science and following argumentation presented by Kuhn (1996), Morin (1999b) and Sterling (2003) sustainable development is believed to be a new paradigm.

2. The paradigm of sustainable development
and its application for the maritime industry

2.1. History of the sustainable development paradigm

Throughout the ages humankind, as an integral part of nature, has interacted with the environment. The unique ability of humans to change the environment, which largely enables our life and wellbeing, now brings negative global results and could even threaten life on the Earth. The development of technologies that allow unlimited utilization of natural resources, together with a constant desire for growth and improvement has altered human interaction with nature into intervention and exploitation. Practised in the long-term, such attitude brings considerable risks for future generations.

Being deeply concerned with the path of degradation, the international community has raised awareness and has taken certain actions to stop threatening trends and to restore equilibrium. Numerous instruments, norms and standards have been elaborated in the last decade in order to reconcile technological and economic development with protection of the environment and social wellbeing, which is now embraced under the umbrella of sustainable development.

Sustainable development has been a focus of the UN's activities for a considerable period of time. Although this research is not aimed at providing a broad historic overview of the evolution of sustainable development, an excursus into its roots would be useful for the understanding of its essence[1].

The majority of publications mark the journey of sustainable development from the late 60s – early 70s of the 20th century, departing from the Intergovernmental

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[1] Broad historic overview and deep philosophical analysis concerning evolution of sustainable development starting from the Enlightment is given by Dresner (2008, pp. 1-66).

Conference of Experts on the Scientific Basis for Rational Use and Conservation of Biosphere, 1968 (Dresenr, 2008, p. 1; UNESCO, 1969; UNESCO, 1993), Meeting of international experts in Founex, 1971 (Ozorio, 1972), or the UN Conference on the Human Environment in Stockholm, 1972 (UN, 1972; UN, 1982). Nevertheless, the backgrounds for international and scientific concern could be traced back even further (Dresner, 2008, p. 9). For instance, the International Institute of Sustainable Development considers Rachel Carson's book "Silent Spring" (1962) to be a turning point in understanding the connections among environment, economy and social wellbeing (International Institute of Sustainable Development, 2012, p.1).

Interestingly, Judge Weeramantry of the International Court of Justice in his separate opinion to the dispute between Hungary and Slovakia concerning the Gabcikovo-Nagymaros Project discovered the roots of sustainable development in ancient irrigation-based civilizations. According to his analysis, irrigation works in Sri Lanka were undertaken "for the benefit of the country" and "out of compassion for all living creatures". In the ancient cultures of the Sonjo and the Chagga Tanzanian tribes irrigation systems were built with a regard to avoiding over-irrigation, water-borne diseases and changes in salinity. The Inca civilization managed to maintain equilibrium between production and consumption with the help of optimum utilization of all resources. Judge Weeramantry brings also examples of underground irrigation channels in Iran and China, which were built thousands of years ago and, some of which are still functioning over two millennia after construction. Buddhist teachings of fauna and flora are mentioned. Remarkably, that balance between technology, environment and society was mentioned not only in literature, but also in technical descriptions and legal sources of that time (Gabcikovo-Nagymaros Project, 1997, pp. 98-106).

Nevertheless, the complexity and global character of current environmental problems could not be comparable to the ancient ones. As fairly summarized by Voigt (2009 p. 12), although "the idea of reconciling the need of development with protection of

environment is not new, the concept of sustainable development in its current understanding certainly is".

The United Nations Educational, Scientific and Cultural Organization (UNESCO) considers the Intergovernmental Conference of Experts on the Scientific Basis for Rational Use and Conservation of Biosphere, 1968, as the first international forum to discuss what is now called sustainable development (UNESCO, 1993, p. 4). The Final Report of the Conference contained 20 Recommendations, many of which were devoted to various aspects of environmental education and training, including: teaching ecology at university level, creating centres for training and research, out-of-school environmental education of youth and adults, and inter-agency coordination on environmental education (UNESCO, 1969).

The next considerable step of the international community was the UN Conference on the Human Environment in 1972 (Stockholm Conference) and the adoption of the Declaration of the UN Conference on the Human Environment (Stockholm Declaration) together with the Action Plan for the Human Environment. Economic and social development were defined as essential for favourable living and working environments; therefore, maximum social, economic and environmental benefits had to be obtained. The Stockholm Declaration and the Action Plan addressed education in environmental matters and protection of marine life (UN, 1982). Moreover, the Plan invited an inventory of educational systems and recommended training/retraining of professional workers from various disciplines at various levels (including teachers) and even encouraged the development of new materials and methods for all types and levels of environmental education (UN, 1972).

The current understanding of sustainable development was coined in the Report of the World Commission on Environment and Development "Our Common Future" (Brundtland Report), which questioned the objectives and direction of society's development and provided the most quoted definition of sustainable development.

The interrelation of economic, social and environmental elements of sustainable development was demonstrated (UN, 1987). Most importantly, this forum made the idea of sustainable development politically accepted (Dresner, 2008, p. 34).

Understanding of sustainable development was improved in 1992 during the UN Conference on Environment and Development (Rio Conference), which adopted the Programme of Action for Sustainable Development (Agenda 21) and the Rio Declaration on Environment and Development. Moreover, the Conference introduced and invited countries to ratify the Convention on Biological Diversity and the UN Framework Convention on Climate Change.

Agenda 21 is a valid comprehensive non-binding action plan of 4 sections and 40 chapters, which reaffirmed the commitment to sustainable development and explicitly defined its pillars: economic, social and environmental. Chapter 17 of Agenda 21 deals with protection of the oceans, all kinds of seas, including enclosed and semi-enclosed seas, and coastal areas and the protection, rational use and development of their living resources. Educational issues are widely addressed, in particular within the maritime context (UN, 1992).

The UN Conference on Environment and Development (Johannesburg Conference), the Johannesburg Declaration on Sustainable Development (UN, 2002a) and the Plan of Implementation of the World Summit on Sustainable Development were the next phase of the paradigm's progress (UN, 2002b). In 2002 these instruments talked about "sustainable development of oceans and coastal areas". Education was recognized as critical point for promoting sustainable development and it was agreed to implement education action plans and programmes at the national, subnational and local levels.

In 2012 the United Nations Conference on Sustainable Development in Rio de Janeiro adopted another important political document "Future we want" and

launched the elaboration of Sustainable Development Goals. This document, in great detail, address the role of marine ecosystems, fisheries and aquaculture, capacity-building, biodiversity, maritime pollution, invasive species, coastal erosion, ocean acidification and fertilization, destructive fishing practices, preservation of coral reefs and mangroves as well as encourages conservative measures such as marine protected areas. However, the section on oceans and seas does not mention education or training. Education is discussed in a separate section with regard to improvement of quality, preparation of people to pursue sustainable development, integration of sustainable development issues into curricula, introduction of special programmes, provision of relevant teacher training, assurance of appropriate learning outcomes as well as implementation of the practice of sustainable management (UN, 2012).

Discussions on the essence and content of sustainable development were conducted during numerous intergovernmental meetings and non-governmental forums. Special institutions and bodies were created at national, regional and local levels, which prepared a variety of documents, reports, and scientific publications[2]. Nevertheless, no universal obligatory international agreement has been adopted.

2.2. Definition of sustainable development

An extensive review of international literature on sustainable development conducted by the Scottish Executive Social Research (2006, p. 23) confirms the lack of uniform understanding of this term[3]. For this reason, sustainable development is often characterized as vague, ambiguous, undefined, and contradictory (Fergus & Rowney, 2005, p. 19)[4]. The situation is further complicated by frequent incorrect references to

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[2] See for instance Timoshenko (1995) and International Institute of Sustainable Development (2012).
[3] Chichilnisky (1997, p. 467), Jabareen (2008, p. 179), Fergus & Rowney (2005, p. 17), Kates et al. (2005, p. 8), Lele (1991, p. 607), Voigt (2009, p. 11) and other authors come to the similar conclusion.
[4] Castro (2004) and Fergus & Rowney (2005, pp. 21-26) in general doubt possibilities of sustainable development within capitalist economy, which always relies on exploitation of natural and social capital and the avoidance of equal wealth distribution. However, it seems that in this approach sustainable development is not considered as alternative solution, which actually could shift the current neo-classical economic paradigm.

this term as a synonym of ecological or environmental (Cabezas-Basurko et al., 2008, p. 2) or mentioning the term in its general linguistic sense.

On the other hand, disagreement about the definition of sustainable development is not seen as meaningless (Dresner, 2008, p. 2) and causeless. McKeown et al. (2002, p. 7), compare sustainable development with great concepts of the human world such as democracy and justice, which, due to their complexity, are all hard to define. Lele (1991, p. 607) considers the vagueness of the term as its strength, which offers an opportunity to extrapolate it to various areas of social life. Thus, the absence of a uniform understanding of sustainable development is caused by objective reasons such as the complexity of its subject matter, its multidisciplinary nature and different beliefs in the ability of technology to substitute for natural resources, as well as subjective reasons such as misunderstanding, deliberate speculation or connotation, which will be discussed in this section.

The World Conservation Strategy, adopted by the International Union for the Conservation of Nature and Natural Resources, elaborated the first definition of sustainable development as development, that

> "takes into account social and ecological factors, as well as economic ones; of the living and non-living resource base; and of the long term as well as the short term advantages and disadvantages of alternative actions" (International Union for the Conservation of Nature and Natural Resources, 1980).

Seven years later the World Commission on Environment and Development formulated probably the most quoted definition of sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Additionally, the Brundtland Commission defined two keys of sustainable development: needs, in particular the essential needs of the world's poor, and limitations imposed by technology and social organization on the environment's ability to meet present and future needs (UN, 1987).

The contradictions found in these interpretations with regard to practical application of the term initiate the need for a deeper semantic analysis of its roots (Figure 1).
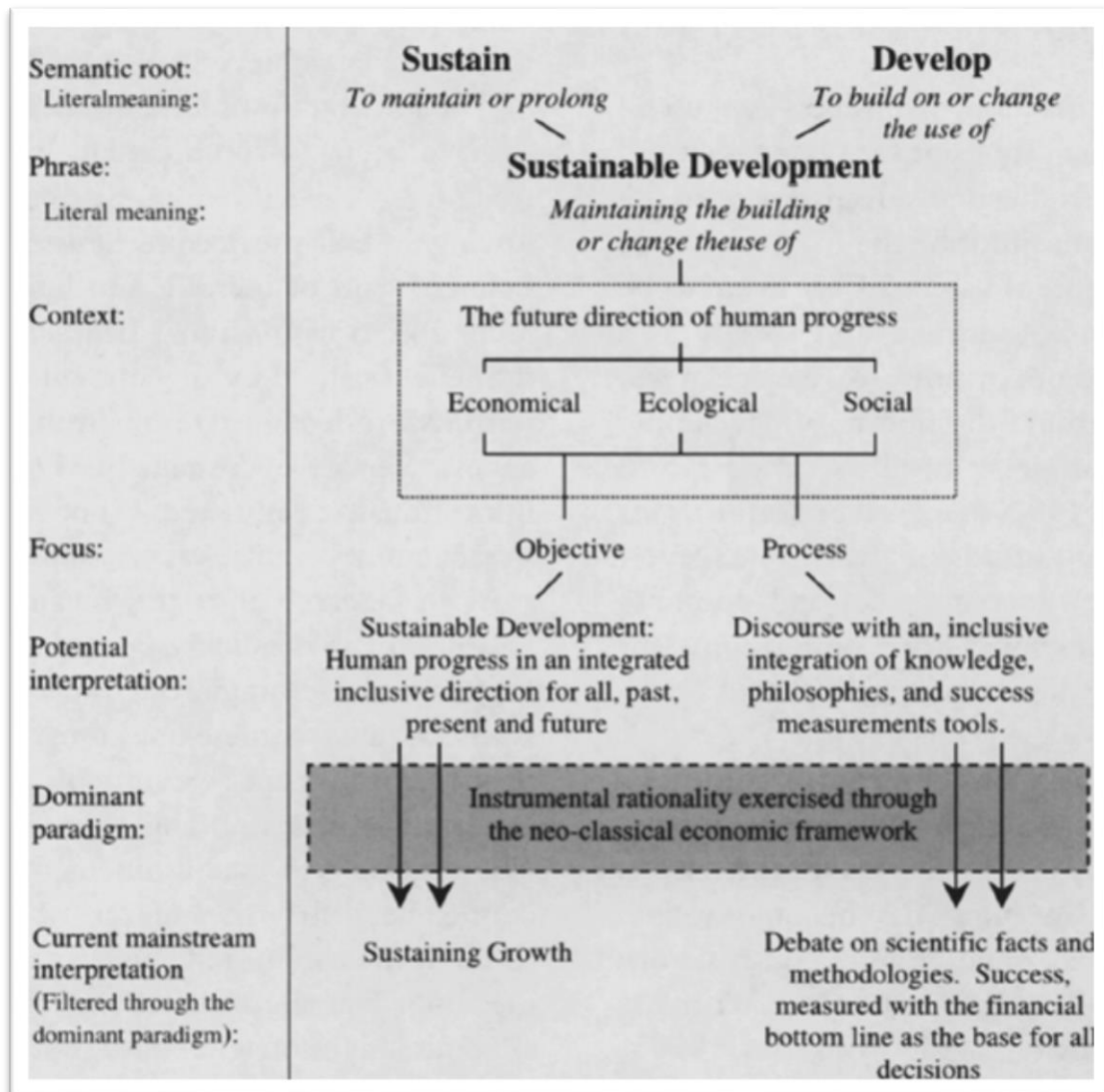
Figure 1. Semantic framework of sustainable development

Source: Fergus, A. H. T. & Rowney, J. I. A. (2005). Sustainable development: lost meaning and opportunity? *Journal of Business Ethics, 60* (1), pp. 17-27.

Sustaining means to keep in existence, to maintain and prolong, while development is generally accepted as a process of directed changes leading to improvement (Bartelmus, 1986, p. 3; Lele, 1991, p. 609; Pearce, 1993, p. 42)[5]. Kates et al. (2005) refer to the U.S. National Research Council study "Our Common Journey: A Transition toward Sustainability" and present a vision on what has to be sustained (the Earth, environment, biodiversity, ecosystems, natural resources, cultures) and what has to be developed (life expectancy, education, wealth, child survival). While some authors see sustainable development as an oxymoron (McCloskey, 1999, p. 157) with contradiction between sustaining and developing, Dresner (2008, p. 2), explaining the difference between sustainable development and sustainability, argues that using the word "development" was a price needed to be paid to get the whole idea of sustainability into political consideration.

Since the Brundtland Report popularised sustainable development, its definition is widely discussed in various fields of science. Cabezas-Basurko et al. (2008, p. 2) fairly note that because of the multidisciplinary character of this term, researchers create different definitions from perspectives of their respective sciences, which eventually makes joint work even more difficult[6].

For instance, Engel (1990, p. 10) understands sustainable development as "the kind of human activity that nourishes and perpetuates the historical fulfilment of the whole community of life on earth". Gladwin et al. (1995, p. 878) present a variety of definitions and finalized sustainable development as "a process of achieving human development in an inclusive, connected, equitable, prudent, and secure manner". Kates et al. (2005) meticulously examine the meaning of sustainable development from numerous perspectives and finally conclude:

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[5] In the context of sustainable development Lele (1991, p. 609) specifically emphasises that objectives and means of development should be separated: in pursuing sustainability final objective might be the same, it's mainly means of reaching it that has to be reviewed. Besides, not only the lack of development but also extensive development can hinder the equilibrium.

[6] As an example, the author demonstrated the confusion between sustainable development and corporate social responsibility.

"sustainable development – a concept that, in the end, represents diverse local to global efforts to imagine and enact a positive vision of a world in which basic human needs are met without destroying or irrevocably degrading the natural systems on which we all depend".

Another set of discussions about sustainable development is caused by differences in appreciation of the role of technology in achieving sustainable goals, in particular whether natural resources could be substituted with the help of technology or should be preserved absolutely, (Dresner, 2008, pp. 3-4) known as "weak" and "strong" sustainability.

Considering the content, sustainable development has three pillars: economic growth, environmental protection and social equality. The relationship between the pillars is crucial for understanding the whole paradigm. To demonstrate the importance of the relations, Morin (1999a, p. 116) gives an example of isomers – compounds with the same chemical formula but different structural formula, which result in different properties. The author believes that "a structure of relationship between components produces a whole with qualities unknown to these components outside the structure" (Morin, 1999a, p. 115). Hence, a correct understanding of the relationship between the three pillars of sustainable development as a whole rather than as a sum of its parts, gives to it different qualities and properties.

The understanding of the relationship between these pillars has changed over the years: from three equal interactive areas to a hierarchy, where economic activities should be conducted taking into account social progress, which, in its turn, must be accomplished within environmental limits as demonstrated by Figure 2 (Scottish Executive Social Research, 2006, p. 23).

Indeed environment, society and economy should not be considered as equally important. Environment a priori has exceptional importance since it determines life on the Earth. Hopwood (2005, p. 48) stresses the dependence of humanity on the environment in which society exists and depends on. Similarly, the economy exists

within society. Moreover, environment could be seen as an initial determinant in social development and economic success in terms of available natural resources and competitive advantages.
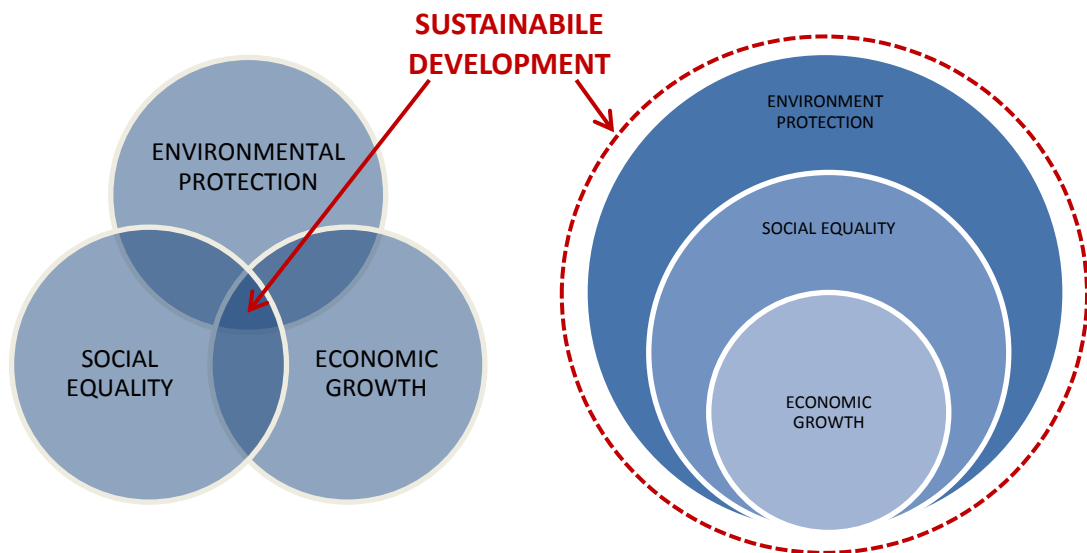
Figure 2. The interrelation between pillars of sustainable development

Consequently, priorities should be distributed among environment, society and economy as in many cases the "win-win-win scenario", advocated by weak sustainability, might be not just practically impossible, but dangerous. In such a case it is the obligation of the government to define a legal framework in order to prioritize certain aspects. For these reason, stakeholders' involvement should be taken with a due care, as mutually beneficial solutions for all stakeholders might be a threat in a broader context.

Currently, additional pillars of sustainable development are proposed. For instance, United Cities and Local Governments (2012) suggest culture, which might be interesting for the MET due to the current practice of multicultural crews. Bossel (1999, p. 17), in order to define indicators for sustainable development, identified the following pillars: individual development, social system, government, infrastructure, economic system, resource and environment. The Scottish Executive Social Research

(2006, p. 30) mentions institutional or imperative pillars. Therefore, it is difficult to claim unity in the theoretical conceptualization of sustainable development.

To summarize, sustainable development is defined in literature as a paradigm (Gladwin et al., 1995; McKeown et al., 2002; Schuftan, 2003), concept (Jabareen, 2008, p. 180; Kates et al., 2005), principle (UN, 1987), process (Gladwin et al., 1995, p. 878), activity (Engel, 1990, p.10) or even type of society. Determining the genus, authors seem to approach the term from the point of view of its components, goals, indicators, values or practical application, but unlikely to Kates et al. (2005), they do not see the complexity of this phenomenon.

The lack of terminological uniformity is observed even among UN agencies:
- o UNESCO understands *sustainable development* as numerous processes to achieve *sustainability*, which is "a *paradigm* for thinking about the future in which environmental, societal and economic considerations are balanced in the pursuit of an improved quality of life" (UNESCO, n.d.-b);
- o FAO defines *sustainable development* as "the management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generation" (FAO, n.d.). Meanwhile *sustainability* is understood as multi-dimensional *concept* "ensuring human rights and well-being without depleting or diminishing the capacity of the earth's ecosystems to support life, or at the expense of others well-being"; sustainability has four dimensions environmental integrity, social well-being, economic resilience and good governance (FAO, 2013);
- o WHO (2011, p. 9) uses the term *sustainable development* referring to a *concept* aimed at "achieving an economic system that can continue to grow, at least over the foreseeable future", while *sustainability* means that

"economic development must occur within the constraints of maintaining intact the ecosystems that support human societies";

o UNIDO (n.d.) and ILO (2012) seem to use the terms *sustainable development* and *sustainability* interchangeably.

For the purpose of this research, the terms "sustainability" and "sustainable development" are also used interchangeably following the reasoning of Dresner (2008, pp. 2, 71). The implication of the term "paradigm" as a genus to the definition of sustainable development is based on its initial meaning introduced by American scientist Thomas Samuel Kuhn (1996), according to which "paradigm" is a model of thinking "...what the members of scientific community, and they alone, share"[7].

Evidence of the applicability of the term "paradigm" to sustainable development can be found from a deeper analysis of Kuhn's theory. According to the author, a shift in paradigms is caused by developing new knowledge that appears as a response to a crisis in science. This new knowledge contradicts existing sets of views, and to address the crisis within the existing paradigm, there is a need for a new one, which encompasses elaborated knowledge. An important factor of a paradigm shift is incommensurability – existing problems could not be solved within the model that generated it.

Current prominent philosopher Morin (1999b, p. 13) also states, that to address the problems of the world, we need a reform in thinking, which should be paradigmatic. Morin (1999b, p. 8) explains the paradigmatic level as follows:

"the paradigmatic level is the level of the principle of selection of ideas to be integrated into the discourse or theory, or refused and rejected… The paradigm, hidden beneath the logic, selects the logical operations that become preponderant, pertinent, and evident under its dominion (exclusion-inclusion,

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[7] Voigt (2009, p. 20) presents convincing amount of international legal documents in different areas of cooperation, which state sustainable development as a goal. This in particular demonstrates the global commitment to sustainable development. Although the application of the term "paradigm" in social sciences was doubted by Kuhn himself, it is believed that its meaning went beyond its initial application and currently used in vocabulary of all sciences.

disjunction-conjunction, implication-negation). The paradigm grants privilege to certain logical operations to the detriment of others, such as disjunction to the detriment of conjunction; and grants validity and universality to its chosen logic. Thereby it gives the qualities of necessity and truth to the discourse and theory it controls. By prescription and proscription the paradigm founds the axiom and expresses itself in the axiom".

Hence, to address the existing environmental and social problems including such complex ones as climate change and poverty, there is a need for paradigmatic reform. Generated by the current economic paradigm these problems cannot be solved using the same way of thinking that has created them. Consequently, there is a need for a new paradigm of sustainable development.

2.3. Sustainable maritime development

Oceans have always been exceptionally important for the purposes of sustainable development. These extremely complex and constantly adaptive natural systems integrate numerous elements including climate and weather, flora and fauna and mineral resources. They remain to be a vital means of transportation, source of food, recreational destination and unique scientific observatory. Moreover, all the elements of this system are united by multiple interconnections among them and are interdependent. As a consequence, oceans have been mentioned in all related strategic documents from the Stockholm Declaration, 1972 to the RIO+20 Conference document "Future We Want", 2012 (Appendix 2).

Due to the complexity of oceans, various aspects of their sustainable development are managed by different UN agencies[8]. For this reason, it is necessary to distinguish the broad term "sustainable development of the ocean" (Hanson, 2012, p. 494) and

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[8] Fishing was managed by the Food and Agriculture Organization, costal development by the United Nations Development Programme, education and science by the United Nations Educational, Scientific and Cultural Organization and the Intergovernmental Oceanographic Commission, technology by the United Nation Industrial Development Organization, environment by the United Nations Environmental Programme, hydrography by the International Hydrographic Organization, communication by the International Telecommunication Union and finally shipping by the International Maritime Organization.

narrow notion of "sustainable maritime development" or "sustainable shipping", which are mainly related to activities of the IMO[9].

Undoubtedly, shipping has direct and substantial influence on sustainable development. Firstly, it facilitates international commerce and economy by transporting 80 % of global trade by volume and 70 % by value (UNCTAD, 2012, p. xiii). Secondly, maritime transport is important from the social perspective as it creates vast job opportunities: 1,3 million seafarers (Drewry Maritime Research, 2012, p. 1) and even more shore-based personal. Thirdly, shipping tremendously impacts the environment (both marine and air)[10]. And finally, in all mentioned aspects, developing countries play a crucial role and constantly increase their share in shipping[11] (UNCTAD, 1995, p. 39).

International concern about environmental, social and economic issues in the maritime industry arose long before the introduction of sustainable development. Negotiations on marine environmental protection started with the Preliminary Conference on Oil Pollution of Navigable Waters in 1926. Drafted during the conference, the treaty was never opened for signature, but was a basis for further discussions. In 1954 the International Convention for the Prevention of Pollution of the Sea by Oil was signed by twenty countries (Churchille & Lowe, 1999, p. 333) and launched the development of a legal framework for the environmental protection.

Social issues were also gradually becoming more important, especially after the publication of the Tavistock Institute of Human Relations report on human element

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[9] Terms sustainable maritime development, sustainable shipping, sustainable waterborne transport, maritime sustainability for the purposes of this research are considered as synonyms.
[10] According to the monitoring report of the EU sustainable development strategy (EU, 2011, p. 227) emissions from international aviation and maritime transport remain the fastest growing source of greenhouse gas emissions.
[11] The UNCTAD Review of Maritime Transport (2012, pp. 9-10) states that in 2011 developing economies loaded 60 % and unloaded 57 % of world seaborne trade versus 34 % and 41 % share of developed economies respectively (the rest of the share is carried out by transition economies).

in shipping casualties (1988) and later the adoption of the Maritime Labour Convention in 2006. Nevertheless, the interrelation between the three components seems to still be underestimated: the industry experiences negative impacts of this misbalance brought by the minimization of safe manning requirements and the International Management Code for the Safe Operation of Ships and for Pollution Prevention (the ISM Code) just to mention few.

Since the paradigm of sustainable development gained international consideration, the UN began to coordinate the process of directed improvement leading the activities of its specialized agencies. IMO's contribution to sustainable development is outlined in its reports to the Commission on Sustainable Development, submitted in 1994, 1999 and 2002. According to the last report, IMO is responsible for the implementation of Chapter 17 of Agenda 21 "Protection of the oceans, all kinds of seas, including enclosed and semi-enclosed seas, and coastal areas and the protection, rational use and development of their living resources" and some issues from other chapters[12] (IMO, 2002, p. 1). A working document of the Marine Environment Protection Committee MEPC 49/14 "Follow-up to UNCED and WSSD: Outcome of WSSD" (IMO, 2003) also determines relevant paragraphs from the Plan of Implementation of the World Summit on Sustainable Development: changing unsustainable patterns of consumption and production, protecting and managing the natural resource base of economic and social development and finally, institutional framework for sustainable development[13].

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[12] In particular, Chapter 3 "Combating poverty"; Chapter 8 "Integrating environment and development in decision-making"; Chapter 15 "Conservation of biological diversity"; Chapter 19 "Environmentally sound management of toxic chemicals, including prevention of illegal international traffic in toxic and dangerous products"; Chapter 20 "Environmentally sound management of hazardous wastes, in hazardous wastes"; Chapter 21 "Environmentally sound management of solid wastes and sewage-related issues"; Chapter 22 "Safe and environmentally sound management of radioactive wastes"; Chapter 24 "Global action for women towards sustainable and equitable development"; Chapter 39 "International legal instruments and mechanisms".

[13] Remarkably, that maritime education and training is mentioned fragmentally in the context of disaster management and biotechnology.

Nevertheless, even in 2006 understanding of sustainability in the maritime industry was reduced to environment:

> "Sustainability in this context is normally understood to mean that any negative impact activity may have on the environment must be reduced to the point where it's clearly outweighed by positive benefit that the activity brings" (Torskiy & Topalov, 2007, pp. 210-211).

The RIO+20 Conference initiated new campaigns on sustainable development and the maritime industry was not an exception. The IMO Secretary-General Koji Sekimizu announced World Maritime Day theme, 2013, "Sustainable development: IMO's contribution beyond RIO+20". In this regard, the Secretariat developed the "Concept of a sustainable maritime transport system" (hereinafter referred as "the Concept") aimed to cover all activities of IMO in the context of sustainable maritime development (IMO, 2013f).

The Concept frequently mentions "sustainable maritime development", but strategically refers to "sustainable maritime transport system", which includes design, construction, classification, ownership, operation, management, pilotage, vessel traffic services, towage, salvage, finance, liability, insurance, training and crewing. Subject to the purposes of IMO, the term does not cover fisheries, offshore resource exploitation and contractual rules[14] (IMO, 2013f, pp. 5-6).

The Concept also defines the goals of sustainable maritime transport system:
- o safety culture and environmental stewardship;
- o education, training in maritime professions, and support for seafarers;
- o energy efficiency and ship-port interface;
- o energy supply for ships;
- o maritime traffic support and advisory system;

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[14] Contractual rules set by the International Convention for the Unification of Certain Rules of Law relating to Bills of Lading, 1924 as amended (the Hague-Visby Rules), the United Nations International Convention on the Carriage of Goods by Sea, 1978 (the Hamburg Rules) and the United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea, 2009 (the Rotterdam Rules).

- o   maritime security;

- o   technical co-operation;

- o   new technology and innovation;

- o   finance, liability and insurance mechanisms;

- o   ocean governance.

To achieve the goals, IMO elaborated a set of actions and named stakeholders responsible for their implementation. However, those goals and actions are not measurable, but rather an expression of a desirable state (IMO, 2013f, p. 5). Therefore, difficulties might arise concerning ways to implement the actions and monitor the achievement of the goals. Another possible threat is confrontation among environmental, social and economic dimensions of maritime transport as, for the time being, they are defined as equally important (IMO, 2013f, p. 5).

Despite the fact that the main shipping areas that require sustainable measures are listed, there is no accepted definition of sustainable maritime development or sustainable maritime transport system. Cabezas-Basurko et al. (2008, p. 2) describes sustainable shipping as:

> "a cost-effective commercial activity, in which the environmental load is not bigger than that which the environment can currently and in the future bear, and that the social community (directly and indirectly) in contact with it is not being negatively affected".

Svensson (2012, p. 5) defines three pillars of sustainable development in the maritime domain as follows:

- o   environmental protection – the environmental load of shipping should not be bigger than that which the environment can currently and in the future bear;

- o social development – incorporates the wellbeing of people who are directly or indirectly in contact with shipping (including education, training and skills, manpower and recruitments, working conditions and rights)[15];
- o economic development – the economic growth of shipping without adversely affecting social and environmental development.

Meanwhile, in the EU the elaboration of the understanding of sustainable maritime development is going in parallel. Sustainable development became an objective of the EU policy through the Treaty of Amsterdam, 1997 and it was integrated into EU transport policy in 1999. At that time five core areas of sustainable transport were defined: CO_2 emissions, pollutant emissions and health impacts, expected transport growth, modal distribution and noise (Svensson, 2012, pp. 6-7). The current EU vision on sustainable transport is defined in the 2011 White Paper "Roadmap to a single European Transport Area – towards a competitive and resource efficient transport system" (EC, 2011a; EC, 2011b) and the Maritime Transport Strategy (Commission of the European Communities, 2009).

In this regard, the EU Maritime Transport Strategy defines a set of measures in order to promote European shipping in global markets, improve human resources, seamanship and maritime know-how, reach a certain level of environmental protection, enhance safety, security, surveillance, promote the role of maritime transport in energy security, improve the regulatory framework, develop short sea shipping in the region, produce better research and innovation (Commission of the European Communities, 2009). Remarkably, one of the first chapters in the Maritime Transport Strategy deals specifically with education and training.

To summarize, sustainable maritime development gained significant international consideration and has been well reflected in related political documents.

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[15] Interestingly, that author includes MET to social development, which actually presents narrows understanding of MET and does not reflect its overall transformative role.

Nevertheless, there seems to be a lack of uniform understanding and vision on sustainable maritime development: goals are not consolidated and actions to achieve them are not allocated among global, regional and national levels. The interrelation between vision on sustainable maritime development as defined throughout UN documents and the role of IMO in implementing the UN vision remain unclear: the final document of the RIO+20 Conference "Future we want" enumerates a significant number of concerns related to sustainable development of oceans and seas[16], but the role of IMO and other actors in resolving those issues is not yet defined.

Krause et al. (1991, p. 627) fairly argue that sustainable maritime development depends on knowledge about the marine environment and on access to this knowledge through training and other means. In this regard, MET is not just one of the aspects of sustainable maritime development, but also a tool to accelerate the proliferation of the paradigm in the maritime industry.

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[16] Healthy marine ecosystems, sustainable fisheries and sustainable aquaculture for food security and nutrition, capacity-building, biodiversity, maritime pollutions, invasive species, coastal erosion, ocean acidification and fertilization, destructive fishing practices, preserving of coral reefs and mangroves as well as encouraged conservative measures like marine protected areas.

3. The concept of education for sustainable development (ESD)

3.1. Education for sustainable development and its principles

From the initial inception of sustainable development, education and training were endorsed as the foundation for effective implementation of the paradigm. Consequently, educational aspects were covered throughout all strategic documents devoted to sustainable development: from the Final Report of the Intergovernmental Conference of Experts on the Scientific Basis for Rational Use and Conservation of Biosphere, 1968 to the UN Resolution "Future We Want", 2012 (Appendix 2).

Although there were notable achievements in promoting primary education and literacy, another significant aspect − the reorientation of education curricula − was largely under-considered (Scottish Executive Social Research, 2006, pp. 126-127). To integrate principles, values and practices of sustainable development throughout all aspects of education, in 2002, UN announced the Decade of Education for Sustainable Development. Following this initiative, educationalists conducted comprehensive studies and analysed related terminology, curriculums, competencies and teaching methods (for instance, Cortese, 2003; McKeown et al., 2002; Tilbury & Wortman, 2004). The Decade was officially launched in 2005 by UNESCO as its leading promotion agency and is supposed to finish in 2014.

At the international level and within UN documentation, the term "education for sustainable development" became generally accepted. "Education for sustainability", "education for sustainable future" and "sustainability education" are believed to be synonymous (McKeown, 2002, p. 7; Sterling, 2003, p. 32). Nevertheless, according to McKeown et al. (2002, p. 7), there is an important distinction between "education about sustainable development" as an awareness lesson, and "education for sustainable development" as a comprehensive tool to achieve sustainable development.

ESD is occasionally taken in simplified denotation with connection to the environmental issues only. However, the concept is extremely immense:

> "education [for sustainable development] is more than traditional practice of environmental education, which focuses on teaching and learning about, in and 'for' the environment. Instead, education for sustainability seeks a transformative role for education, in which people are engaged in a new way of seeing, thinking, learning and working [...] Educators require a new set of skills, such as envisioning, critical thinking and reflection, dialogue and negotiation, collaboration and building of partnerships" (Tilbury & Wortman, 2004, p. 9) [17].

As defined by UNESCO, ESD is aimed at acquiring "the knowledge, skills, attitudes and values necessary to shape a sustainable future" (UNESCO, n.d.-a). It should not be seen merely as a separate subject or programme, but is rather an educational concept, which affects legislation, policy, curriculum, teaching, learning, assessment and other educational components. Sterling (2004, p. 50) emphasizes, that ESD is neither an addition to existing structures and curricula, but a "change in educational thinking and practice". Fundamental educational theories, concepts and definitions seem to be well researched and established in the modern pedagogy. Nevertheless, education and training practices are constantly evolving according to developments in society and science. Therefore, these practices are to be periodically reviewed and redefined. This is exactly the case with the inception of sustainable development.

Consequently, the required from students skills would be complex thinking, system thinking, critical thinking, holistic approach, flexibility, envisioning, and problems solving abilities[18]. One of the most important tasks in ESD is learning for change, which is based on "relating multiple perspectives to each other at all times" (Ottosson & Samuelsson, 2008, p. 11). According to the authors, these perspectives

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[17] Sterling (2003, pp. 32, 310) believes that appeared in 1992 term "education for sustainable development" broadened "environmental education". More detailed analysis of the relation between environmental education and ESD is presented by Hesselink et al. (2000), Sauve (1996, pp. 8-15), Wals & Kieft (2010, pp. 14-17).

[18] Problem solving should be done in a way that solutions are not going to generate new problems.

include: space, time, culture and different disciplines, as well as a non-anthropogenic perspective. Students are expected to identify problems and to find solutions relevant to a particular context, be able to define substantially interested stakeholders and work in co-operation with them, and understand interrelationships between parts and the whole. They should be able to see mistakes, errors and illusions.

Wals & Kieft (2010, p. 17) summarize the essence of ESD as capacity building for sustainable development, which enables people to contribute to its goals in a meaningful and contextually relevant way rather than simple training or instruction. Above all, the overall cognitive aim of ESD is to enable students "to think through influence and make their minds of where they want to go" (Tilbury, n.d.) and "to prepare the mind to confront the constant threat of error and illusion that parasitize the human mind" (Morin, 1999b, p. 1).

3.2. Extrapolation of the ESD in MET

While announcing the 2013 World Maritime Day theme "Sustainable development: IMO's contribution beyond RIO+20", MET was mentioned among eight pillars of sustainable maritime development. In this regard, consequences for MET remain unclear: is there a need to review MET systems and curriculums? Which MET subjects are affected by the sustainable maritime development and in what way? Are there any specific teaching/learning and assessment tools to be applied or skills to be demonstrated?

Despite the absence of answers to these concerns, there seems to be no discussion among MET professionals yet. Currently, the vision of sustainable development in MET is limited to "continuous supply of quality seafarers and maritime experts required for all aspects of the maritime industries including shipbuilding and marine equipment manufacturing industries" (IMO, 2013c). However, this approach limits the understanding of MET to a demand derived from the maritime industry and

underestimates the transformative role of education. This perspective actually endangers values of sustainable development, where economy, technology and industry should be seen as functions of society.

It was discussed earlier that environment, society and economics should not be seen as equal dimensions. The current environmental crises create an undeniable need for prioritization. Similarly, education and training system should not be built to satisfy the needs of the industry, but in a way to lay a foundation to change industrial practises. Unfortunately, current education systems are to great extent defined by the labour market requirements and the needs of the industry, and MET is not an exception to this rule.

The contribution of MET to sustainable maritime development should be seen in a much broader perspective. As education is believed to be a precondition of any form of development, MET should be considered as a precondition and tool for achieving sustainable maritime development. Although IMO recognized the key role of MET in achieving IMO's objectives (IMO, 2013e, p. 4), it has not yet been reflected in strategic documents.

In order to facilitate the adoption of sustainable development values in the maritime industry, it might be useful to explore the possibility of extrapolation of ESD achievements in MET and contextualised pedagogical measures developed by ESD to the maritime domain. The International Implementation Scheme Report (UNESCO, 2005, p. 30) stresses that ESD could not have a standard universal model, principles of ESD should be adapted to the particularities of a region, country, university or subject. As described by McKoewn et al. (2002, p. 13) "ESD carries with it the inherent idea of implementing programs that are locally relevant and culturally appropriate". Consequently, MET will have diverse forms, which would be different from the MET model before sustainable development, but much more specialized compared to ESD.

ESD as an overall educational concept provides some methodological help to find solutions for the raised questions. The importance of reviewing educational systems in order to reach sustainable development was demonstrated earlier. MET as well as education in general, is a powerful tool to contribute to the aims and objectives of sustainable maritime development. Therefore, it should be reviewed through the lens of aims of sustainable maritime development and objectives of the seven other pillars: safety culture and environmental stewardship; energy efficiency; new technology and innovation; maritime security and anti-piracy actions; maritime traffic management; maritime infrastructure development; and global standards at IMO. McKeown (2002, p. 24) stress, that "to create an ESD curriculum, educational communities will need to identify knowledge, issues, perspectives, skills, and values central to sustainable development in each of the three components - environment, economy, and society". For these reason, there seems to be a need to review curriculums within MET programmes in order to integrate issues of sustainable maritime development and to provide students with hard skills (knowledge) needed to address those issues. However, what issues are to be integrated depends on how sustainable maritime development is seen and what particular sustainable development goals are defined.

According to the principles of ESD, adopting sustainable maritime development in MET should not be just additional knowledge in the form of a separate discipline or a topic within a discipline[19]. It requires the overall revision of the subject concerned, concentration on tools to work with issues rather than fixed solutions to those issues. In addition, new ways of thinking, new skills and an interdisciplinary approach have to be incorporated[20]. Subsequently, it requires special assessment methods.

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[19] However, such scenario is recognized as a first step towards ESD (Hopkins & McKeown, 1999, p. 26) or as an alternative (Calder & Dautremant-Smith, 2009, p. 94).
[20] The value of interdisciplinary approach in MET is emphasised by Benton (2009, p. 297) on the example of the California Maritime Academy.

The problem of implementing the achievements of ESD in MET might appear due to the fact that competences introduced by the concept of ESD are not a "minimum standard", as we are used to thinking in MET, but rather a permanent goal (UNECE, 2012, p. 8). Therefore, it would be difficult to define standard competences. Even if such standards could be elaborated, they will have a high level of abstraction and, subsequently, require contextualization.

Exploring the possibility of extrapolating ESD in MET, it is important to note, that ESD concerns learning at all levels, including vocational education, training for educators, professionals and decision makers (UNECE, 2005, p. 18). This fact becomes crucial for the maritime industry as vocational education and training are able to develop professional skills, which would directly impact the industry processes. McKeown et al. (2002, p. 16) emphasise while education is "a socially transforming process that gives people knowledge, skills, perspectives, and values through which they can participate in and contribute to their own wellbeing and that of their community and nation", training has direct impact and "informs people of accepted practices and procedures and gives them skills to perform specific tasks".

4. Challenges in the maritime industry
related to sustainable maritime development

Bearing in mind the interrelation and interdependence of the maritime industry and MET, it is expedient to analyse challenges and trends of the maritime industry in relation to sustainable development before elaborating any propositions on "sustainable MET".

4.1. Sustainable maritime development: growth or decline in shipping?

The majority of publications dedicated to the future of shipping and sustainable maritime development build predictions and suggest strategies on the assumption of growing seaborne trade. However, current world trade volumes are growing slower than was anticipated by the International Monetary Fund (BIMCO, 2013). The UNCTAD Review of maritime transport, 2012 concludes that international seaborne shipments continued to grow in 2011, albeit at a slower rate than in 2010 (UNCTAD, 2012, p. xiv). Interestingly, in EU maritime policy transport growth and economic growth are already decoupled (Przybylowski, 2010, p. 199; Svensson, 2012, pp. 6-7).

While the current drop in world trade is reasoned by ecomonic factors such as low demand, financial instability, political and social unrest, natural disasters, impact of austerity measures and others, the proliferation of the sustainable developmnent paradigm might imply an additional decrease in trade. As discussed in Chapter 2, sustainable development is not necessarily related to growth, but rests upon the idea of development as a process of directed changes leading to improvement. Actually, implementation of principles of sustainable development such as recycling, minimization of consumption, preference to local and regional trade may result in the opposite trend – decline of trade or at least its considerable alteration. In combination with evolving tendencies on limitation of trade by natural recourses, virtualization of

trade[21] and protectionism policies (Forum for the Future, 2011, p. 11) it does not necessary mean that world trade and seaborne trade are going to grow in long-term.

The above mentioned has no intention to prove the unavoidable decline of trade but is rather an invitation to consider alternative scenarios for future shipping and most importantly to elaborate the optimum balance between the unrestrained desire of growth and the need for sustainable development. Considering the sustainable development paradigm in its initial meaning without substitution to "sustainable growth", as it is currently happening in numerous publications[22], would definitely raise the question of optimal trade volumes. Therefore, it is important to envisage the revolutionary impact of the paradigm for society and, consequently, world trade.

Meanwhile, shipping remains dependent on world trade. With freight market volatility, shipping, for objective reasons, is not able to react on such changes immediately. When for some mysterious reason there are considerable modifications in trade, the best that could be done in shipping is to reveal new trends first and try to avoid negative consequences or in best situation to take an advantage of the situation. If, in such uncertain system of relation between trade and shipping, education and training are considered as a demand derived from shipping, functions of MET becomes vulnerable. The sole fact that students are enrolled in, on average, 4 year programmes is just one example to demonstrate a range of challenges derived from the lack of predictability.

Therefore, to ensure sustainable development in MET, one should think of its reorientation from just a derived demand to a flexible and adaptive system providing additional employment opportunities for seafarers. That could mean, for instance,

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[21] For instance, the International Electrotechnical Commission recommends to trade with electricity via long-distance transmission rather than to ship coal and oil (Forum for the Future, 2011, p. 18).
[22] For instance, Lloyds List (2013) reports the aim of sustainable development in maritime industry as "to address the problem of ensuring growth in shipping while adhering to stringent environmental regulations", and "to address and recognise the serious financial challenges faced by shipping", which are exactly the opposite from the initial understanding of sustainable development.

restoring double purpose training, developing courses for re-qualification as well as making educational programmes flexible with a variety of skills.

4.2. Shipping without fossil fuels

Predictions concerning continuously growing world trade and the axiom of shipping being purely a derived demand from trade seem to underestimate the current situation of limitation of resources (Figure 3), increasing emission regulations and absence of acceptable, in the large scale, technical solutions to substitute fossil fuels.
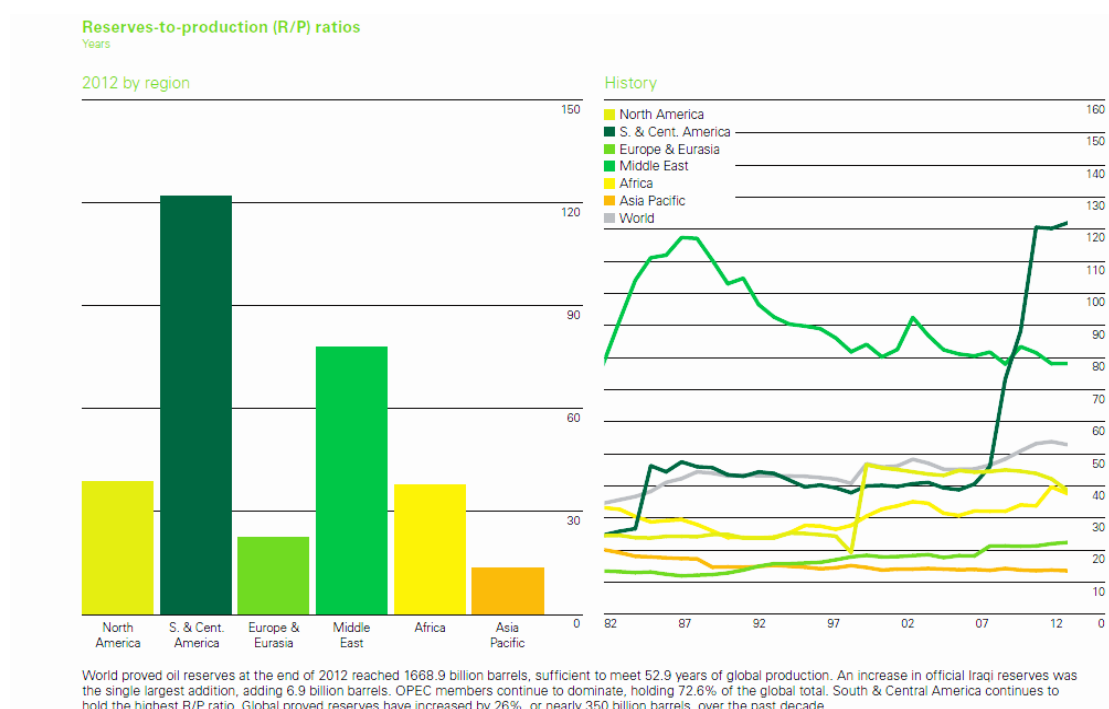
Figure 3. World Crude Oil Reserves, 2012

Source: BP. (2013). *Statistical Review of World Energy June 2013*. Retrieved September 1, 2013 from http://www.bp.com/content/dam/bp/pdf/statistical-review/statistical_review_of_world_energy _2013.pdf.

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The consequence of limited oil recourses has been observed through the years in growing fuel prices. The direct result of this trend is increasing shipping costs, which may eventually lead to a decrease in shipping efficiency and impose restriction on world trade itself, changing the interdependence between trade and shipping. Together with emerging techniques for low-cost automated production and a growing middle class in fast-developing nations (Forum for the Future, 2011, p. 18), growth of trade might not be as expected. Forum for the Future (2011, p. 42) argues:

> "Changes in the price of carbon and key commodities such as bunker fuel are outside the control of the shipping industry, but they clearly have a fundamental effect on operational and investment decisions, as well as on customer demand […] While recent oil price spikes have resulted in operational changes such as slow steaming, they have not yet driven a significant enough shift in future price expectations to move the industry towards a tipping point around hull, propulsion and renewable energy technologies. In this respect the industry has yet to really experience the need for change".

Whether the future scenario is decline of shipborn trade or need to retrofit existing ships with new technology, the question will arise concerning the future demands of labour markets and, consequently, optimization of MET according to the new context.

4.3. Internationalization of cost

McGuire & Perivier (2011, p. 72) and Chomsky (2000) stress that sustainable development is, to a large extent, related to the internalization of costs, which demonstrates the true value of our actions. Indeed, over a long period of time, the economy was growing at the expense of exporting renewable and non-renewable natural resources at considerably lower price using cheap labour for both production and transportation without bearing in mind hidden consequences for environment, society and wellbeing of developing countries. Acknowledging the actual value of the environment and society in both material and non-material perspectives and,

consequently, altering the economic practices is the first step to sustainable development.

Despite the fact that the issue of environmental costs was widely popularized after 1987 due to the Brundland Report (Dresner, 2008, p. 36), the impact assessment finds that no internalisation has been made in maritime transport (McGuire & Perivier, 2011, p. 72; Svensson, 2012, p. iii). For instance, the European Commission concluded that "charges and taxes do not fully reflect the societal costs of transport [....] Attempts to internalise transport externalities and to remove tax distortions have so far been unsuccessful" (EC, 2011b, p. 10).

Svensson (2012, p. 10) sees the reason for the failure of internalization of environmental costs in European maritime transport in leaving the pricing policy to national consideration of Member States. Consequently, maritime transport was exempted from the EU Directive on energy taxation and actions on reducing greenhouse gases were left to the consideration of IMO.

Meanwhile, there is a strong opposition to internalization of environmental costs in the maritime industry and attempts to substitute its initial meaning with the opposite notion, that the burden and cost of complying with environmental regulations should be "shared by society, rather than pushed only on to the shipping industry" (Lloyds, 2013). This view was also proposed by the industry to IMO: "the burden and cost for compliance with the stringent emission control standards, such as the sulphur regulations, should be shared by society equitably rather than be pushed onto the users, i.e. the shipping industry" (IMO, 2013f, p. 16).

The opposing of internalization of costs in shipping is usually reasoned by the need to transport enormous volumes of basic materials and goods at a relatively low cost, which otherwise would not be in the public interest and would be detrimental to growth and prosperity in civil society as a whole (IMO, 2013f, p. 6). However, it

should be noted that the majority of transported materials are commodities for the needs of industry (Figure 4). While the question that has to be asked is how maritime transport managed to keep transportation costs low? McGuire & Perivier (2011, p. 72) believe that it became possible at the expense of the environment and cheap labour, which allowed the international costs of maritime shipping to be kept artificially low.

	1980	1985	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012
Container	102	152	234	371	598	969	1 076	1 193	1 249	1 127	1 275	1 385	1 498
Other dry cargo	1 123	819	1 031	1 125	1 928	2 009	2 112	2 141	2 173	2 004	2 027	2 090	2 219
Five major bulks	608	900	988	1 105	1 295	1 709	1 814	1 953	2 065	2 085	2 335	2 477	2 547
Oil and gas	1 871	1 459	1 755	2 050	2 163	2 422	2 698	2 747	2 742	2 642	2 772	2 796	3 033
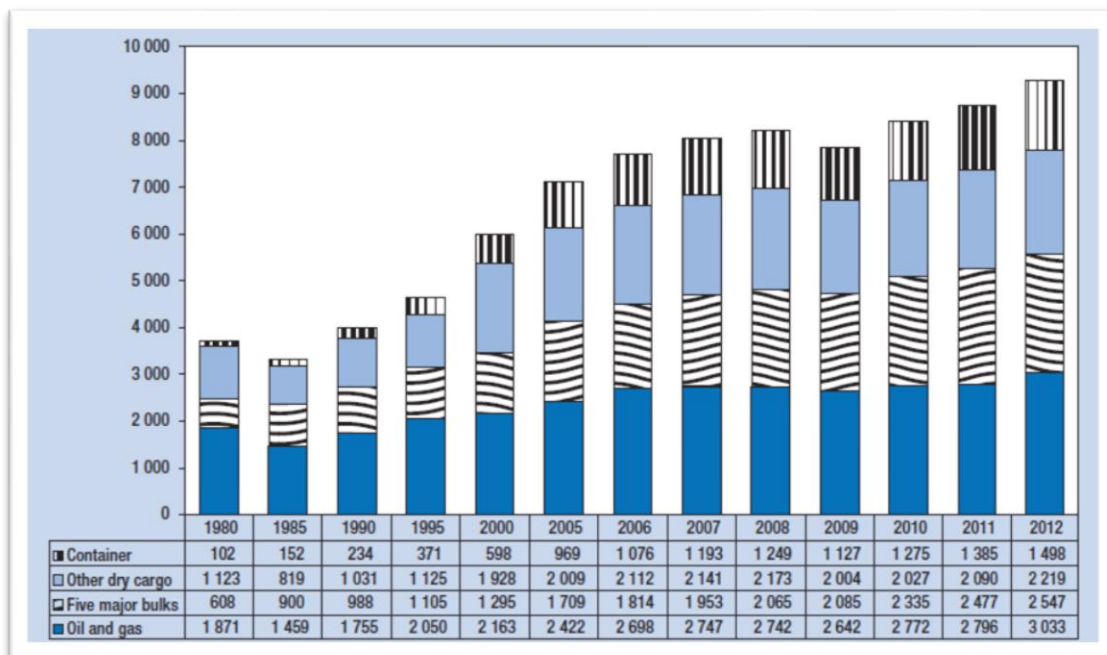
Figure 4. International seaborne trade, by cargo type, selected years (millions of tones loaded)

Source: UNCTAD. (2012). *Review of maritime transport 2012*. New York-Geneva: UN, p. 9.

It logically follows that attempts to internalize environmental costs will likely increase the cost of shipping goods and further impact on supply-and-demand chains (McGuire & Perivier, 2011, p. 76). Consequently, the question of whether environmental costs are going to be internalized and in what way leaves a number of considerable alterations for the development of shipping.

4.4. Development of international and national regulatory framework

Proliferation of ocean management, exponential growth of regulations, strengthening of enforcement measures and respective institutional changes are reportedly having the highest transformative impacts on sustainable development in general as well as in the maritime industry (Boardley, n.d.; Forum for the Future, 2011, p. 29; Scottish Executive Social Research, 2006, p. 130). Indeed, one of the defining features of the last decade in the maritime industry is an inception of new and strengthening of existing regulatory and institutional measures in order to ensure the fulfilment of international obligations, culminating in the announcement of the World Maritime Day theme, 2014 "IMO Conventions: Effective Implementation" (IMO, 2013b).

IMO Model Audit Scheme as an example of regulatory measures has gradually evolved since June 2002, when it was first proposed during the 88th session of the IMO Council, into mandatory audit: IMO Instrument Implementation Code and Member State Audit Scheme are expected to be adopted by the IMO Assembly at its 28th session in late 2013. Consequently, states will be required to undergo periodic audits by the IMO, which will assess whether maritime administrations have established procedures to enforce international instruments they are parties to. In the domain of the STCW Convention, the scope of audit will cover communication of information, recognition of certificates, port state control, fatigue prevention as well as prevention of drug and alcohol abuse (IMO, 2013e).

The challenge for the industry lies not only in strengthened enforcement measures, but also in the unpredictability of regulatory developments, which in the maritime domain are often caused by incidents:

> "The megatrends highlight that it is uncertain how regulation will influence the shipping industry in future. Its influence is still likely to be significant, but there is a risk that there will be a less coherent set of rules because of different regional approaches. The trends also highlight that climate change may result in more major weather incidents that could lead to crisis-driven

regulation which may impact on shipping" (Forum for the Future, 2011, p. 42-43).

Together with advancement of information and communication technologies, whose impact is discussed below, activities of shipping companies may become increasingly transparent leaving less place to hide for poor performers.

4.5. Advancement in information and communication technologies in shipping

Tremendous developments in information and communication technologies as well as spread of independent social media have dramatically changed the way business operates due to unrestricted access to information and transparency. Forum for the Future (2011, pp. 22-24) anticipates, that this trend will not bypass the shipping industry and will actually challenge its commitment to declared sustainable development goals.

It is believed that customers of the future will be concerned not just with price and security, but also with other performance factors such as working conditions, vessel efficiency, emissions and other criteria. This approach corresponds to a new emerging image of young people, known as "generation Einstein" – self-motivated and active members of democratic society, that have independent progressive values, directed into universal and individual welfare rather than financial enrichment and live "on the top of Maslow's pyramid" (Boschma, 2013).

Notteboom (2006) argues that the maritime industry will have to demonstrate a high level of environmental and safety performance in order to ensure community and political support as well as attracting trading partners and investors. Certain performance standards might be introduced similar to Energy Efficiency Design Index (EEDI), which enables customers to select more sustainable companies and ships. Most likely this trend will firstly reflect upon container trade, which is traditionally associated with highly visible brands. Consequently, that might influence port dues and insurance arrangements, which are already discussed in the EU (EC, 2011b, p. 68).

Eventually, the proliferation of information and communication technologies together with activities of non-governmental organization using social media and increasing public concern about the environment are expected to require the shipping business not just to declare its commitment to sustainable development but to actually follow up on it. However, this might not be the case in countries with low levels of democracy, where companies are committing to progressive "green" tendencies with an intention to obtain various material and non-material benefits by demonstrating such pseudo-commitments, but are not going to follow expensive "green" policies. This becomes possible due to low public involvement and pressure on business and lack of democratic institutions (media, NGOs, courts) to raise the issue and protect public interests[23].

The above mentioned issues are not intended to be an exhaustive list of challenges in the maritime industry arisen due to the need of perusing sustainable goals, but rather a demonstration of confusion, ambiguity, uncertainty and complexity among current trends in shipping. Starting from considering sustainable maritime development from two absolutely opposite perspectives and revealing the possibility of changes in basic axioms of the maritime industry, the chapter reveals some issues able to considerably alter shipping, and respectively MET. While long-term predictions are difficult to elaborate, the following chapter will analyse the current challenges and trends specifically in MET and the possibility to address them bearing in mind the long-term challenges.

The maritime industry, by definition, is a rapidly changing area within which prediction of the future is deemed to be extremely difficult or impossible. In such an environment, impediments exist for sufficiency of MET functions. To diminish this danger, a new MET concept is required, which would encompass teaching/learning methods aimed at enabling students to acquire useful knowledge and skills in an ever changing environment.

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[23] The problem of not fulfilling obligations despite taken commitments to do so was discussed in regard to international law by Hathaway (2005) and Yasuaki (2003).

5. Improvement of MET
in regard to sustainable maritime development

5.1. Future demands for maritime professionals

Analysed current trends and challenges in the maritime industry appear as a set of variables allowing a wide range of future scenarios rather than a clear development path. The situation is complicated by frequent misunderstanding, misapplication and speculation of basic principles of sustainable development and as a consequence contradiction between them and current perceptions on development in the maritime industry, which are seen as the biggest threats to true transformation. Additionally, forecasts for maritime labour market are methodologically built on the existing practices and does not effectively consider sustainable scenario, perhaps due to the absence of clear vision of sustainable maritime development as such.

In these circumstances, it seems impossible to elaborate the exact functions of MET and competences required in for sustainable maritime development apart from the need for the proliferation of the sustainable development paradigm, relevant research and nurturing related to unpredictability soft skills such as flexibility, envisioning, critical thinking and others. Nevertheless, whatever perception of sustainable development is going to be accepted, it is expectedly going to influence all maritime professions, imposing new responsibilities.

Meanwhile, a considerable number of MET issues remain, not having been properly addressed[24]. The reason is that the contemporary state of relationships was initially built without due consideration to social and environmental aspects. Though the time maritime industry tried to adapt to new requirements, to absorb and accommodate

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[24] For instance, the shortage of maritime professionals (KNOWME, 2012) and qualified teachers/ instructors (Cross, 2010), declining level of competence (Froholdt & Hansen, 2011), implementation of life-long learning (Daochang et al., 2002), rapid technological changes (Notteboom, 2003), addressing environmental issues (Lewey & Pourzanjani, 2001) and others.

related concerns, the existing system is still based on the predomination of economic values. Hawken & Lovnis (1999) describe the current set of relationships as neglecting "to assign any value to the largest stocks of capital it employs – the natural resources and living systems, as well as the social and cultural systems that are the basis of human capital". Therefore, in developing a sustainable model for MET existing weaknesses and threats have to be taken into consideration in order to build a system of relationships able to address current challenges in a long-term perspective.

A comprehensive SWOT analysis in relation to future demands of maritime professionals was conducted by the KNOWME project[25]. In order to define requirements for human capital in modern shipping, the project carried out a survey among maritime administrations, ports, shipping companies, and transport agencies from Sweden, Germany and Greece (Appendix 3)[26], which reveals valuable information that should be taken into account during the development of a sustainable model for MET.

The survey demonstrates that working skills and knowledge are believed to be the biggest strengths and opportunity from the standpoint of seafarers and shore-based workers. In the labour market, professional knowledge and skills are valued as 79 % of all strengths for officers and 59 % for ratings with some room for improvement in the latter case. At the same time, employees identify this area as the biggest weaknesses due to the lack of communication and social skills, English proficiency, practical skills and experience. In shore-based positions, the most vulnerable aspects are the lack understanding of a ship and on board practices as well as outdated knowledge or lack of knowledge of new technologies. However, employers do not

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[25] The KNOWME project covers the main issues addressed by the European Commission in the „Maritime Transport Strategy 2009–2018" and in general terms aims to address the problem of growing shortage of maritime professionals (KNOWME, n.d.).
[26] Despite the fact that the survey was conducted within Europe, which definitely limits its application, research outcomes are valuable as an example and a model for analysis of global, regional and national contexts.

consider the area of skills and knowledge as a serious issue, but wish slight improvements.

Working conditions and various social aspects remain the biggest weakness of seafaring careers: long hours of work, fatigue, stress, inspections, risky working environment, isolation and separation from families make this career path unattractive. Interestingly, similar conclusions were achieved in a survey conducted among seafarers by the Japan International Transport Institute (2010, p. 14) and Shiptalk Recruitment Limited (2007, pp. 2-3). According to the latter, social aspects of this profession including separation from families (68 %) and lack of communication facilities (70%) remain the biggest concern.

According to Shiptalk Recruitment survey, the attractiveness of seafaring professions remains to be propelled by salary rates (32%) and, consequently, 67% of respondents choose this factor as the reason to stay at sea. Another benefit mentioned is specific aspects of work such as freedom and long leaves (16%; KNOWME reports 19%). However, the surveys did not mention the frequently practiced disproportion between months of work and leave, when in worst cases seafarers spend 9 months on a ship and only 2 months ashore (44% of seafarers wish to have shorter voyages). In any case, long vacations are inseparable from long voyages, which inevitably bring the above mentioned social implications. Seafarers, particularly when they start their own families, tend to choose a shore-based job in order to stay close to their families (Kitada, 2010).

Although in shore-based positions the situation seems to look better, stress, pressure and long working hours remain problematic. For port employees, working environment is obviously the biggest concern due to dangerous and hazardous environment. Remarkably, that maritime industry does not notice social issues and working conditions among weaknesses or threats with the only exception in this regard being cultural issues (less than 6 %).

The attitude to market, future of shipping, technology and innovation is ambiguous and seen as both giving opportunities as well as imposing threats. Generally these aspects are mentioned in a negative context (among employees in average 43 % as a weakness and 32 % as a strength, while employers obviously are more concerned with this aspect - 54 % and 44 % respectively). However, the maritime industry seems to see a way out in the advancement of technology (25 %), which proves the prevalence of a weak sustainability approach. Salary and wages are mentioned mainly as strengths of these professions. But in the labour market, it gains bigger attention and serves as a point of discontent.

All the three groups of employees as well as the maritime industry in general do not mention the importance of environmental issues. On the contrary, at the organizational level, environment is actually seen as an opportunity (11 %), rather than a threat (7 %), which seems not to correspond to the actual situation.

To summarize the results, in light of sustainable development the survey reveals the following:
   o environmental aspects are not appreciated by employees or employers; regulatory measures, through which environmental requirements are imposed on shipping, are generally seen as a threat;
   o social issues remain the biggest concern among seafarers, decreasing the attractiveness of maritime professions; nevertheless, employers do not mention it as a threat, being occupied mainly by economic factors;
   o current economic conditions are mentioned as satisfactory while future developments are seen as ambiguous and mainly threatening with a belief in technological advancement.

As predicted by IMO (2013f, pp. 9, 14) for seafaring professions, new equipment together with evolving shipboard procedures will lead to crews performing new or

different functions and, therefore, necessitate follow-up training. Therefore, according to IMO, the first goal of sustainable MET is properly trained and educated seafarers with an emphasis on refresher training and education upgrades.

The second goal is derived from the increasing role of developing countries in shipping and also the need for qualified shore-based personnel. Hence, the IMO objective in this regard is training and education of non-seagoing maritime professionals (legal, engineering, ship management and port careers), especially in the developing world.

Another important challenge identified by IMO and EU is how to attract and retain a sufficient number of adequately trained and qualified seafarers and maritime industry professionals (KNOWME, 2012; IMO, 2013f, p. 9). Thus, another goal is improving the welfare of seafarers as an important precondition for a better and more attractive work environment as "failure to do so will make it increasingly difficult to recruit and retain quality seafarers" (IMO, 2013f, p. 14).

Consequently, the following actions are determined by IMO in order to provide respective knowledge, skills and conditions for achieving its defined goals:
- o promotion and recognition of seafaring as an attractive career choice;
- o strengthening the development of maritime professional careers;
- o elevating the profile of maritime education and retraining (on-shore and on-ship) as ongoing career opportunities by ensuring they are tailored for future challenges including innovation and evolution of technology;
- o promotion and development of initiatives to ensure global uniformity and better coordination of maritime education and training, including developing and updating model courses and training methods to meet new technical demands as well as the evolving profile of modern seafarers, including at-sea training and e-learning;
- o promotion of on-board training;

- o promotion of fellowships for maritime industry professionals from developing countries;
- o continue to recognize the role of the human element in the development of all future regulations and operational practices, in particular with respect to new technologies and innovations;
- o continuous promotion of fair treatment of seafarers, taking into account their working conditions and sailing patterns as well as avoiding criminalization;
- o continue to work with ILO to improve the quality of life, including living conditions, of seafarers, particularly those on long duty cycles, bearing in mind the need to retain qualified seafarers.

However, the Concept neither require a review of curriculums as recommended in UN documents (Appendix 2) nor take into account UNESCO achievements concerning the implementation of sustainable development in education and training. Most importantly, it also does not acknowledge the need for professionals able to formulate, evaluate and implement sustainable policies and strategies, as well as perform other specific functions needed for achieving sustainable development goals.

Above all, development of human resources is a precondition to any form of development (Couper & Gold, 1993, p. 577). Hence, the role of MET should not be seen in a narrow sense – as a derived demand to satisfy the needs of the industry. MET also has a transformative role and could be designed to initiate changes in current practices and implement a future vision (Benton, 2011, p. 69). These two functions are extremely important and have to be taken into account in order to provide students with job-related skills and enable them to be flexible in a rapidly changing environment.

5.2. Curriculum development process

A broadly accepted vision of curriculum design is that its first and foremost purpose is to equip students with knowledge and skills required to build/improve their qualification and competence (Fisher & Muirhead, 2005, p. 13). In practical terms this standpoint means that the aim and learning outcomes of a course have to be relevant to on-the-job responsibilities and, therefore, are defined by the way the maritime industry operates and its needs. Thus, curriculum design and education in general are considered as derived from industry demand, where MET institutions are suppliers of human capital for the maritime industry. Needless to say, the overall aim of a curriculum in such a scenario would be to fit the existing processes of the maritime industry. It is believed, that this is the perspective not only of vocational education and training, but increasingly becoming the trend in academic educational establishments (Gadotti, 2010, p. 204; Robinson, 2010).

Notwithstanding, as any other area of education, MET has to be considered in a broader context – as a pathway to science and a precondition of advancements in the maritime industry. This transformative function becomes especially important in periods of crisis and considerable changes, when there is a need for creative solutions or proliferation of changing concepts. The current environmental crises and the need for implementation of the sustainable development paradigm in the maritime industry confirm the need for broader perspectives on MET. The approach to curriculum design would have to change accordingly.

As was discussed earlier, the focus of integrating sustainable development in education and training is the "reorientation of the current formal education curriculum" (Gadotti, 2010, p. 204). A key point in directing curriculum, as McKeown et al. (2002, p. 28) indicate, is the decision between "teaching about

sustainable development" and "teaching for sustainable development"[27]. Despite the fact that the latter is a more difficult intellectual exercise, teaching about sustainable development could be appropriate for undergraduate education and programs oriented for the operational level.

An indispensable step in the process of developing and implementing a new model of MET is to ensure that administrators, managers and educators appreciate the concept of ESD as well as principles of sustainable development in general. Caston (2013) shares his experience in the curriculum proposal process and emphasizes the difficulty in introducing transdisciplinary curriculums into an academic environment, which may be reluctant to accept this emerging paradigm. Therefore, engaging faculty in curriculum development becomes *sine qua non* in the effective organization of this process[28].

In particular, such an approach is beneficial for educators as it will provide them with knowledge needed to evaluate their courses and craft the appropriate solutions. McKoewn (2002, p. 28) stress:

> "Once they understand the concept of sustainability, educators from each discipline can examine the curriculum and school activities for existing contributions to ESD. Next, educators can identify potential areas of the existing curriculum in which to insert examples that illustrate sustainability or additional knowledge, issues, perspective, skills or values related to sustainability".

The revision or design of curriculum should start with answering a number of important questions concerning the future programme or course, in particular:

o how to implement theories into reasonable and engaging learning experiences that students can understand and see connection with their lives?

o would it give them an edge in getting a job?

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[27] However there is also resistance of some educators to educating *for* any movement (Hopkins, 2012, p. 2).
[28] See Caston, 2013; Matarazzo-Neuberger & Filho, 2010, p. 274; United Nations Economic Commission for Europe, 2012, p. 10-12.

o   what is the value of this type of qualification in the labour market?

o   why would a student opt to complete the certificate (Caston, 2013)?

The following phase is an analysis of competencies required for maritime professions in light of sustainable maritime development. Wiek et al. (n.d.) emphasizes the lack of scientific research in this area, however, there are numerous examples available on competences and curriculums for bachelor's and master's programmes in sustainable development (Appendix 4 and Appendix 5), which could be extrapolated for MET.

Once competencies are identified, there is sufficient information to develop curriculum. During this process, designers should use methodologies elaborated under the concept of ESD in regard to course aim, learning outcomes, teaching materials, and most importantly assessment, which remains to be one of the strongest motivators in learning. Additionally, curriculum has to reflect a relationship to the subject goals of sustainable maritime development and build the capacity to achieve them.

Hanson (2012, p. 504) argues that much of the training available today on subjects related to the marine and ocean environment and sustainable development primarily focus on pollution control and prevention, and, to a limited extent, on integrated management concerns in the marine ecosystem. Unfortunately, as Edwards (2012, p. 23) notes, "not all institutions of higher education include all three aspects of sustainability in their efforts". Hence, due attention has to be paid to ensure the revision of economic and social related disciplines.

In the initial stage of designing MET curriculum when new concepts are not yet well reflected in literature, preparation of teaching materials is most likely to be one of the problems restraining educators. To create knowledge, management of an MET institution might use such instruments as research, conferences and seminars on sustainable maritime development issues together with horizontal and vertical collaboration.

Development and implementation of curriculum related to sustainable development might impose other specific strengths and weaknesses as well as opportunities and threats, which have to be identified with the help of relevant analytical instruments and addressed[29]. Overall, it is important to realize that success in implementing sustainable development principles in MET will, to a large extent, depend on the international and national political perceptions of sustainable maritime development as Caston (2013) argues:

> "I would like to say that curriculum design is free of any a political process; however, that is naively idealistic. In fact, curriculum design and the politics of the culture in which the curriculum exists are so intimately intertwined, they are inseparable. Is curriculum not a direct reflection of society's norms, hopes, and expectations? And is politics not the agreed upon structure by which society functions? This ultimately begs the question – What is the purpose of education? The intent here is to simply highlight that the question exists. Without recognizing this question and the resulting entanglement of education and politics, this process would be exponentially harder. Systems theory predicts that systems seek homeostasis and it is from within this state that new structures emerge. But when a new structure is thrust upon a system, the system resists that challenge. In this case, homeostasis is maintained by the political environment while the curriculum design process serves to bring forth new emergent qualities. A healthy political environment […] supports and nurtures new curriculum".

Therefore, designing and implementing a curriculum related to sustainable development imposes considerable challenges on MET institutions. Firstly, it requires a reorientation of institutional policy and a review of the overall aim of education. And secondly, it examines the understanding of sustainable development by management and educators along with their critical approach towards existing practices. If these challenges are overcome successfully, knowledge and skills in sustainable development might be introduced in MET as a separate bachelor's or master's programme, as an additional course in existing programmes or a topic within the most relevant course.

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[29] An example of SWOT analysis in developing curriculum on sustainable development is given by Smith (2011, p. 9).

5.3. Sustainable maritime development as a programme, discipline and topic

Successful proliferation of sustainable maritime development depends on participation and accurate understanding among all actors in the maritime industry. Consequently, a certain degree of education and training has to be distributed among all occupational levels: from policy makers, governmental officials and maritime administrators to professionals in shipping and port management. Therefore, the need for knowledge and skills in sustainable maritime development will vary significantly among MET programmes depending on:

- o the level of educational programme (undergraduate or postgraduate);
- o character of responsibilities for future profession (managerial or operational);
- o relevance of the profession to sustainable maritime development;
- o particularities of the national, regional and international maritime policy and practices of the industry.

Shipping practices and maritime policy are important for curriculum as they basically identify the current stage of the industry and objectives for future development, while the role of MET in this process is to prepare competent professionals to be able to complete the transformation. In any specific context such as sustainable maritime development, maritime policy additionally defines the objectives of development and instruments to reach these objectives and thereby transmits to curriculum designers information on competency requirements – particular knowledge and skills needed for transformations.

For instance, the European Commission has adopted a vision of sustainable maritime transport system (EC, 2011, 2011a, 2011b) and defined its objectives such as to reduce greenhouse gas emissions, to improve ship dismantling, to improve navigation in extreme conditions and others. In such cases, maritime professionals are expected to have relevant knowledge and skills, and be to be able to operate with

the proposed concepts. Therefore European MET institutions have to bring those issues into classrooms.

In determining the needed amount of knowledge, the relevance of a profession to sustainable maritime development has to be considered as it will significantly vary among programmes on maritime administration, maritime law and policy, maritime ocean and costal management, marine environment, maritime commercial law, port management, navigation, and engineering. This is the crucial factor to be taken into account by management of MET institutions in making a decision as to whether sustainable maritime development is going to be implemented as a separate programme, as a discipline or just as a topic within a relevant discipline.

McKeown et al. (2002, p. 28) in regard to ESD stress that each country has to decide on a method of implementing the concept – whether to create another "add on" subject (e.g., sustainable development, environmental education) or to reorient existing education programs and practices to address sustainable development. Ottosson & Samuelsson (2008, p. 39) believe otherwise that ESD should not to be treated as a separate subject in the curriculum but rather a way of dealing with all the curriculum subjects. However, both approaches sound too general if applied to MET. In this educational area the decision on the manner in which to teach sustainable development is to be made in regard not only to a country, but also specific MET institution or even programme and depends on the criteria listed earlier. As McKeown et al. (2002, p. 14) stress, "it is not only a question of quantity of education, but also one of appropriateness and relevance."

Knowledge in sustainable maritime development might be introduced in MET as a separate bachelor's or master's programme. For instance, this approach was accepted by the Australian Maritime College (Bachelor's degree in Marine Engineering with specialization in Sustainable Design and Risk) and the Memorial University of Newfoundland in Canada (Bachelor's degree in Sustainable Aquaculture in Fisheries).

Another way to introduce knowledge related to sustainable maritime development is through a separate discipline, which would be crucial for programmes related to policy making, ocean and costal management, and maritime spatial planning. For these specialisations, courses on sustainable maritime development could offer an overview of selected current challenges in the maritime industry and tools to deal with such challenges on the basis of an interdisciplinary approach. It would not be enough to teach *about* sustainable maritime development as one the most important tasks for these professions is to define objectives for sustainable development. Hence, teaching *for* sustainable development is required.

For these programmes, courses on sustainable maritime development should probably be taught at the end of the educational programme. Therefore, students would most likely already have knowledge about existing challenges and awareness of tools to manage them. This is typical for ESD when "many topics inherent in ESD are already part of the formal education curriculum, but these topics are not identified or seen to contribute to the larger concept of sustainability" (McKeown et al., 2002, p. 25). Under these conditions, the purpose of the course should be to demonstrate the complexity of the maritime industry, and the interrelation and interdependence between economic, environmental and social aspects. Students should learn to evaluate context in a systematic way, define priorities for maritime development, cooperate with stakeholders, generate acceptable solutions, evaluate the consequences of application of certain tools, anticipate future developments and resolve the conflicts.

Principles of sustainable maritime development should also be introduced in programmes, graduates of which are expected to implement policy measures such as shore-based maritime professions including port management. Presentation of this knowledge could be done as a separate topic in a related course, short professional

development course or seminar. Examples of separate courses on sustainable development issues include:

- o Australian Maritime College: course Marine Environment and Society in Master's programme in Maritime Studies;
- o Korean Maritime University: course Sustainable Design;
- o Polytechnic University of Catalonia (Spain): course Marine Pollution Prevention and Sustainability in Bachelor's programme in Marine Engineering and Bachelor's programme in Nautical Engineering and Maritime Transport; course Quality Management, Safety, Environment and Sustainability in Bachelor's programme in Systems Engineering and Naval Technology;
- o Dokuz Eylul Universit (Turkey): course Sustainable Maritime Transportation Management in Ph.D. programme in Maritime Security, Safety and Environmental Management.

An example of a professional development course in sustainable maritime development is introduced by the State Enterprise on Caspian Sea Issues and the International Ocean Institute with support of the President of Turkmenistan – Sustainable Development and Governance of the Caspian Sea (Training Programme on the Sustainable Development and Governance of the Caspian Sea, 2013, pp. 11-12). The curriculum of the programme was divided into the following modules:

- o oceans and seas, governance frameworks – governance, legislation and issues specific to the Caspian Sea legal regime, international principles of good governance;
- o managing relations with the oceans and seas – the principles of sustainable development, tools for the management of sustainability and marine matters (maritime spatial planning, GIS, remote sensing, costal management), topical examples of case studies relevant to the Caspian states (hands-on exercise by the class where the principles introduced were applied in themed exercises which fed into the final course work);

o governance for the Caspian sea – specific topics of Caspian regional governance framework, possible scenarios/roadmaps.

The need to integrate a separate course on sustainable maritime development in the education of merchant marine officers is not yet generally accepted. Certain principles of ESD are indeed appropriate for this type of MET such as problem-solving, system thinking, and interdisciplinary approach (Benton, 2009, p. 302). Merchant officers are also expected to have knowledge and skills related to implementation of legal instruments and company policies related to sustainable development; however, the appreciation of interrelation between those aspects is to be yet improved.

The literature review demonstrates that understanding of "sustainable development" and "sustainability" in education and training of seafarers is often reduced to a continuous supply of qualified seafarers (KNOWME, 2012; IMO, 2013c), which does not correspond to the initial meaning of sustainable development in education as proposed by UNESCO. That is not to deny the existence of a gap between competences required on job and qualification of graduates, need for knowledge updating or lack of qualified personnel. However, this is a common phenomenon that appears not only in MET but other areas of education as well, which should be addressed appropriately, but has minimal relation to the concept of ESD.

WMU might be one of the first MET institutions introducing sustainable maritime development as a programme, discipline or professional development course. In this regard a sample of curriculum was developed for a course on Sustainable Maritime Development (Appendix 6) taking into account practical recommendations given by Caston (2013), Matarazzo-Neuberger & Filho (2010) and Smith (2011) and samples of sustainable maritime development related curriculums prepared by the Polytechnic University of Catalonia in Spain.

5.4. Implementing sustainable practices in management of a MET institution

Apart from curriculum, success in the proliferation of sustainable maritime development in MET is considerably related to the way educational institutions operate in terms of their overall policy: planning, structure, faculty and staff development, research, scholarships and awards, and operations (Association of University Leaders for a Sustainable Future, n.d.).

The importance of implementing sustainable practices in management of educational institutions is one of the core principles of ESD, according to which the best learning outcomes are achieved in active learning. The commitment to this principle was renewed during the RIO+20 Conference, which encourages educational institutions to consider adopting good practices in management on their campuses and in their communities (UN, 2012, p. 45).

The philosophy behind this principle was explained by UNESCO, which came to a conclusion that to believe in sustainable development, students need to see its principles applied as they "are very aware of the difference between what is said in class and what is practiced by individuals, the institution, and the community" (Smith, 2011, p. 12). This phenomenon is known as hidden curriculum, "norms, values and beliefs that students learn from the social context of the educational institution, both in the lecture hall and in the organization as a whole" (Manuel, 2010, p. 356).

Commitment to sustainable development by MET institutions is most likely to be made through policy documents together with other voluntary commitments taken within corporate social responsibility. It is probably not appropriate to recommend policies, strategies or any organizational arrangements regarding implementing sustainable processes as it will disregard the context of a particular institution[30]. Most

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[30] However, related suggestions could be found in Matarazzo-Neuberger & Filho (2010), McKeown (2002, p. 44), Smith (2011, pp. 9-15), Sterling (2003, p. 343).

importantly, as emphasized by Sterling (2003, p. 343), such activities of an education institution should be done in a systematic way.

However, as an example, the Massachusetts Maritime Academy made the first step towards sustainable development by stating the academy's commitment to a greener future and signing a national declaration of universities and colleges, oriented on the proliferation of sustainable development. Afterwards, the Academy completed a greenhouse gas inventory, prepared a Climate Action Plan, introduced energy and water management, green cleaning and purchasing programmes, recycling, research into alternative energy processes and other measures. Nowadays, the Academy "is also developing and implementing academic courses into its degree programs to enhance the education of cadets and prepare them for a future that will include sustainability in their chosen vocations" (Massachusetts Maritime Academy, 2012). More examples are given in Appendix 7.

Rapid reorientation of educational establishments towards sustainable practices is facilitated by the emergence of networks that are sharing experience and practical recommendations as well as instruments to manage, measure[31] and improve their sustainable performance[32]. As an example, the Association of University Leaders for a Sustainable Future lists 119 degree programmes related to sustainable development only in Australia, Canada, Ireland, Italy, Mexico, Netherlands, Norway, Sweden, United Kingdom, and United States. Moreover, the Association mentions 159 websites devoted to campus sustainable programs, projects and committees at institutions of higher education.

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[31] See Sustainability assessment questionnaire for colleges and universities (Association of University Leaders for a Sustainable Future, n.d.).
[32] For instance, The Sustainability Tracking, Assessment & Rating System, Learning for Future Environments, The International Sustainable Campus Network, the Association of University Leaders for a Sustainable Future, the Association for Promoting Sustainability in Campuses and Communities, the Association for the Advancement of Sustainability in Higher Education Academic Programs, Guide to Universities with Environment Sciences Degree Programs, Sustainable Design Consulting.

5.5. Application of sustainable practices in MET institutions

To review the application of sustainable practices in MET a survey was accomplished throughout official web sites of such institutions. Bearing in mind the difficulty of defining an "MET institution", analysis was conducted among members of the International Association of Maritime Universities (IAMU): 56 educational establishments from 31 country (Asia and Pacific – 13, Europe – 18, Americas – 9, Africa and Central Europe – 16). To ensure the reliability of the survey, institutions with limited amount of information on comprehensible languages[33] were excluded from the review and, therefore, conclusions should be seen as representing 43 MET institutions.

The survey has a number of limitations. The overall restriction in determining sustainable practices in MET institutions is related to the difficulty of defining sustainable development. Noticeably, some institutions apply principles of ESD (for instance, problem-based learning and interdisciplinary approach), but do not refer to sustainable development as such. Another common trend is separation of sustainable practices on activities related to environmental protection, social welfare and economic stability.

A second limitation is caused by the fact, that the survey is based only on the information posted on the official web sites. Thus, an error might exist as for various reasons institutions might not wish to provide certain information on the Internet such as, for example, detailed curriculums or management of recourse. On the other hand, published information might be distorted due to marketing reasons. Nevertheless, conclusions of the survey are valuable and demonstrate the level of acceptance of various sustainable practices in management of MET institutions.

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[33] English, Russian and Ukrainian.

The most important outcome of the survey is that 65% of MET institutions acknowledge the importance of sustainable development and have implemented at least some sustainable practices (Figure 5). Establishments in the Americas appear to be the most dedicated to sustainable development, while more than 50% of institutions in Africa and Central Europe do not provide any information about sustainable development on their web sites. However, it should be mentioned that the review of information provided by institutions in Central Europe and Asia creates an impression that they publish on the Internet just the most important information and do not generally pursue marketing purposes.
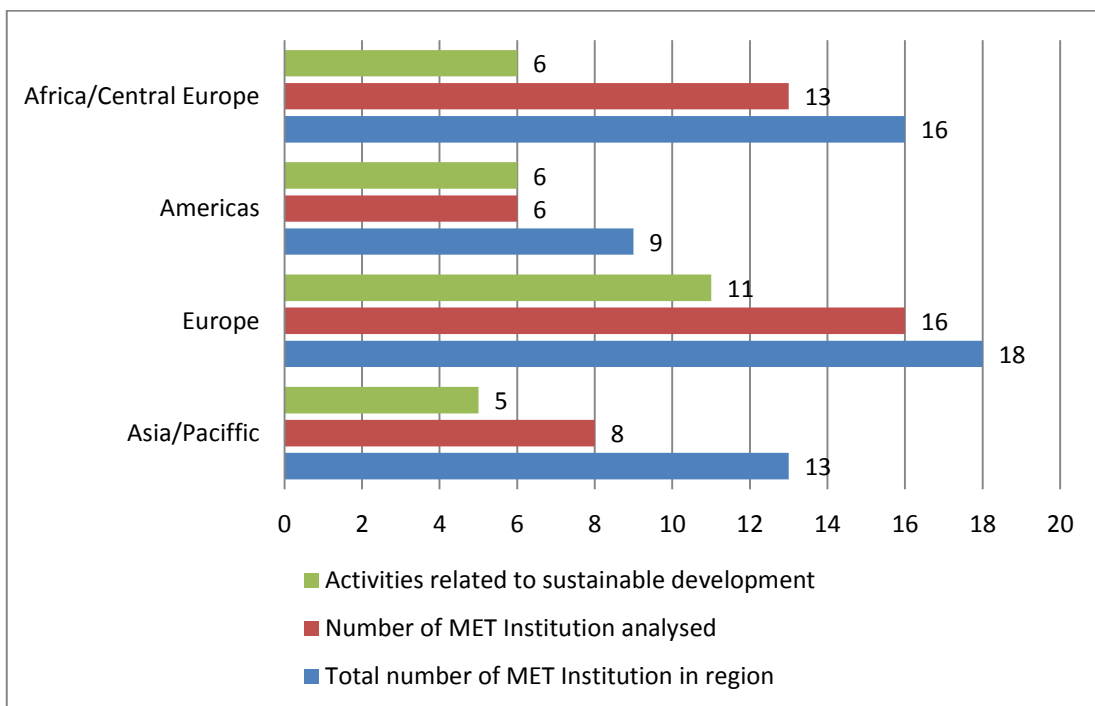
Figure 5. Activities of MET institutions
related to sustainable maritime development in amount, by region

Most frequently, sustainable development issues are mentioned in research projects (33 %) and scientific events (37 %) such as conferences, seminars and academic publications (Figure 6). This actually demonstrates that sustainable development is still not fully understood and researched but is rather an emerging concern among

MET institutions. Hopefully, this trend could be considered as proof of rising awareness, which will eventually propel respective changes in practices.
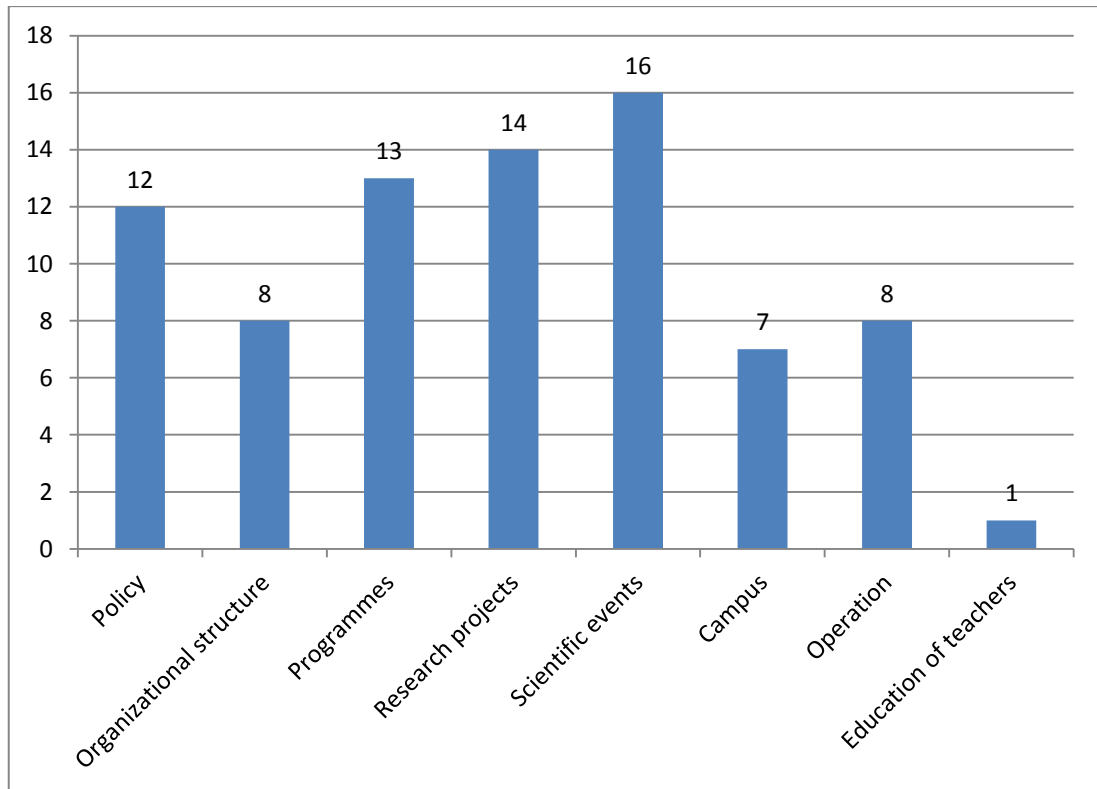
Figure 6. Activities of MET institutions
related to sustainable maritime development in amount, by type

Since research and education have always been closely interrelated some MET institutions have introduced separate elements of sustainable development in educational processes as recommended by the ESD concept: separate master programmes (5%), courses for bachelors, masters or Ph.D. students (14%), competence requirements (12%) with general representation of 30%. However, only three universities confirmed the need for knowledge about sustainable development in education of merchant marine officers. It is important to mention that large universities providing educational services not only in the maritime field but in other areas of knowledge seem to be more active on sustainable development. However,

even in those institutions, sustainable practices were not always implemented in maritime departments and faculties.

Considerable attention to sustainable development is dedicated in policy documentation (28 %). Unfortunately, that often remains just a declaration and in best case scenarios is supported by research projects and scientific events but usually does not cover all aspects of management of MET institution. Sustainable policy is often reflected in organizational structures through special centres, institutes, committees, research groups, officers or even through special position such as Assistant to the President for Sustainability (19%). Nevertheless, operation as well as management of campuses are not considered appropriately.

A separate issue in the proliferation of principles of sustainable development in MET institutions is training of academic personnel. Despite the fact that academics have an opportunity to acquire knowledge concerning sustainable development through research activities and scientific events, separate training on how to educate for sustainable development seems to be unappreciated.

5.6. Recommendations for improvement

Summarizing the discussion on improvement of MET in regard to sustainable maritime development, it is important to emphasize that implementing sustainable practices does not mean exclusively improving competitiveness by reduced operating costs and enhanced customer loyalty. Similar to the maritime industry, sustainable development in MET does not necessarily imply a "win-win-win scenario", but rather signifies reorientation of policy – mission, objectives, values and outcomes.

To initiate the transition towards sustainable development, the following actions are recommended:

1) to review policies and other strategic documents in order to introduce principles of sustainable development (preferably by reviewing existing documents rather than adopting separate documents) including procedures related to planning, operations and procurement, faculty and staff development;

2) to proliferate knowledge about sustainable maritime development among managers of MET institutions, lecturers and instructors (train-the-trainer programmes, conferences and seminars on related topics);

3) to analyse the need and possibility for introducing separate programmes on sustainable maritime development or courses within respective programmes;

4) to review existing curriculum in order to reflect the sustainable maritime development issues and ESD concept:

   4.1) to ensure coverage of sustainable maritime development issues in existing courses (hard skills);

   4.2) to nurture related cognitive skills including critical thinking, system and complex thinking, envisioning, and problem solving (soft skills);

5) to encourage research on sustainable maritime development issues.

6. Summary and Conclusion

The United Nations Conference on Sustainable Development, 2012 has brought the issue of sustainable development to the consideration of the international community once more. Despite all the efforts in proliferation since the Brundtland Report, sustainable development is still far from being universally implemented and achieved. This research identified that the complication is due to the lack of adequate appreciation and misinterpretation of the notion of sustainable development.

Sustainable development should be considered a paradigm as defined by Thomas Kuhn, meaning a model with particular principles. Categorizing sustainable development as merely a concept is underestimating its role and scope, and amounts to its denial. Applying Morin's complexity theory, sustainable development would become revolutionary if it was considered as a replacement to the current paradigm of development, not just an add-on.

Additionally, the application of sustainable development is jeopardized by mistakenly considering its three pillars as equally important. In fact, the economy is a system within society, which depends on the environment, a clear subordination of elements.

Evidently, these two errors bring confusion not only to theory but also to practise. Sustainable development still remains a subject of political documents and matter of voluntary commitment, while its implementation is stagnating with lack of paradigmatic reform. Essentially, the success of sustainable development solutions seems to depend solely on their commercial value.

The application of the sustainable development paradigm in the maritime industry seems to be also problematic. There is no consensus among maritime experts about the definition of sustainable maritime development. Furthermore, the term is often

used in the sense of "perpetuation" of the current state of maritime affairs, but now with the consideration of environmental and social aspects.

Moreover, sustainable maritime development is frequently associated with economic growth; however, it might not necessarily have that implication. On the contrary, the application of the principles of sustainable development in the maritime industry might result in a decline of economic activities in the traditional sense. Such a manner of endorsing a particular kind of idealism is dangerous. Therefore, prior to any further actions it might be wise to adopt a precautionary approach.

As an attempt to be in line with the RIO+20 Conference, the International Maritime Organization recently published "A Concept on a Sustainable Maritime Transport System". There are three critical observations on this document. First of all, this document seems to anticipate the UN's effective action strategy to implement sustainable development in accordance with "Future We Want"; however, unsuccessfully. The IMO's document falls short in the interpretation and application of the sustainable development paradigm, emphasizing the economic element. Evidence of this is the withdrawal of the term "development" from the document's title. Nonetheless, there are references to sustainable development throughout the text.

Second, the document has not been endorsed by IMO Member States through existing mechanisms of validation, such as circulars or resolutions. Therefore, it is a visionary statement for the time being, that needs further upgrading.

And third, even though goals are clearly stated, actions are defined as "activities" in broad and general terms without proper delineation of an effective action plan, meaning what, why, who, how and when.

All in all, the determinant for successful implementation of the sustainable development paradigm is education. Therefore, the UN has been making vigorous efforts to spread the concept of ESD as transformative pedagogy to prepare society for a transition to the new paradigm. Consequently, sustainable development in MET requires reorientation, resource allocation and capacity building to implement sustainable maritime development. Instead, it is often related to "continuous supply of seafarers" or MET institution's financial stability, which are unsuitable associations. Although these associations are misleading, they might be actually the result of improper education.

To conclude, after the Second World War, nations of the world combined efforts and established the United Nations Organization, with the primary aim "to save succeeding generations from the scourge of war". Taking into consideration the current threats to humanity, the United Nations has adopted a new goal "to meet the needs of the present without compromising the ability of future generations to meet their own needs". This vision still needs to be accepted at the paradigmatic level, and education is the most powerful tool in this regard.

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Appendices

Appendix 1
Mind mapping exercise
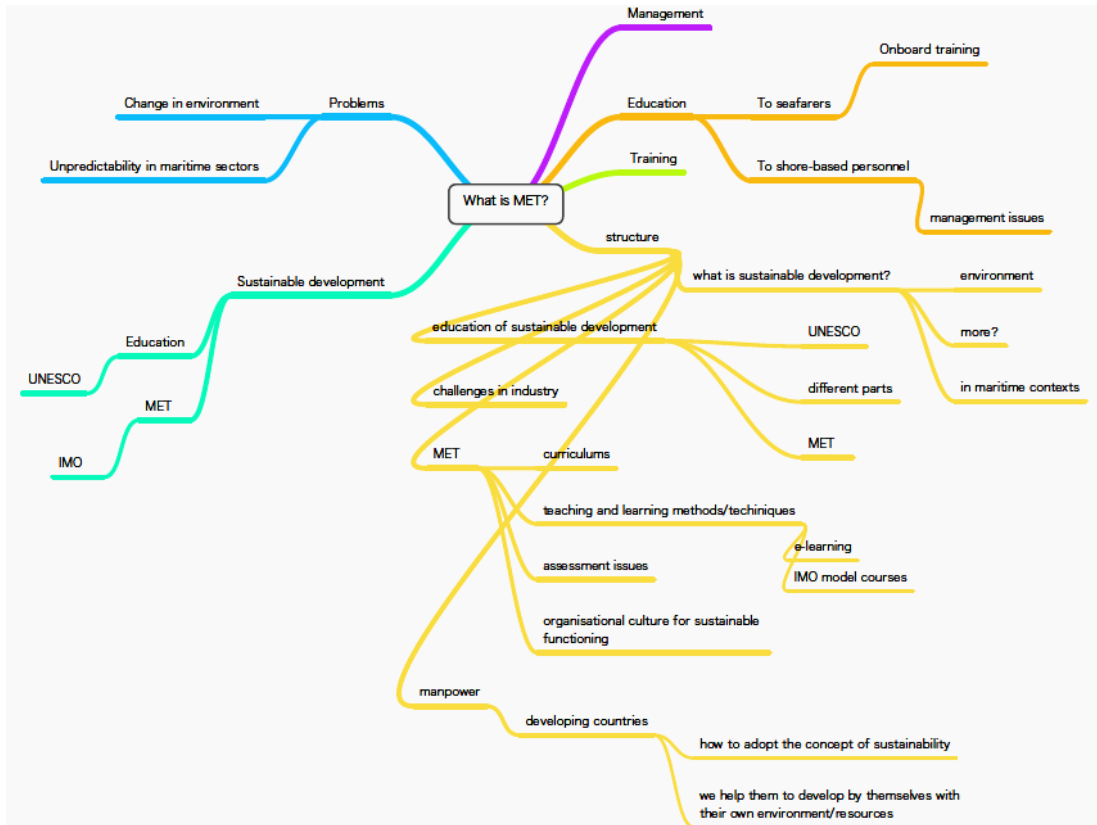
Appendix 2

Progress of the paradigm of sustainable development

(with an emphasis on maritime and educational issue)

Year	Document / Event	Main Provisions
1968	Intergovernmental Conference of Experts on the Scientific Basis for Rational Use and Conservation of Biosphere Adoption of the Final Report of the Conference	The first international forum to discuss and promote what is now called "sustainable development". The Final report had 20 Recommendations, including: Recommendation 10 Teaching Ecology at University Level; Recommendation 11 Centres for Training and Research in Rational Use and Conservation of the Resources of the Biosphere; Recommendation 12 Out-of-School Environmental Education of Youth and Adults; Recommendation 13 Inter-Agency Co-ordination on Environmental Education; Recommendation 16 Multidisciplinary Research and Training Centres for Resource Inventory and Evaluation.
1971	Meeting of international experts in Founex, Switzerland Adoption of the Founex Report	The Founex Report called for integration of environment and development, emphasised that environmental problems might be result of underdevelopment and proposed to integrate environmental concern into education curricula.
1971	UN General Assembly Resolution 2849(XXVI), Development and environment	The Resolution stated, that development plans should be compatible with a sound ecology and that adequate environmental conditions can best be ensured by the promotion of development. Marine pollution and related matters also have to be considered in the forthcoming United Nations Conference on the Law of the Sea and Inter-Governmental Maritime Consultative Organization Conference on Marine Pollution.

1972	UN Conference on the Human environment, Stockholm Adoption of the Declaration of the UN Conference on the Human Environment and of the Action Plan for the Human Environment	The Declaration defined, that economic and social development is essential for ensuring a favourable living and working environment for man and for creating conditions on earth that are necessary for the improvement of the quality of life (Principle 8). Adverse effects on the environment have to be avoided; maximum social, economic and environmental benefits for all are to be obtained (Principle 15). Science and technology, as part of their contribution to economic and social development, must be applied to the identification, avoidance and control of environmental risks and the solution of environmental problems and for the common good of mankind (Principle 18). Education in environmental matters, for the younger generation as well as adults, claimed as essential in order to broaden the basis for an enlightened opinion and responsible conduct by individuals, enterprises and communities in protecting and improving the environment in its full human dimension (Principle 19). Protection of marine life and legitimate uses of the sea, the discharge of toxic substances and the release of heat, problem of non-renewable resources are mentioned. The Action Plan addresses marine pollutions (Recommendations 86-94) and educational, informational, social and cultural aspects of environmental issues (Recommendations 95-101). Recommendation 96 encouraged an inventory of existing systems of education, which include environmental education; training and retraining of professional workers in various disciplines at various levels (including teacher training); the development and testing of new materials and methods for all types and levels of environmental education.
1972	UN General Assembly Resolution 2997(XXVII), Institutional and financial arrangements for international environmental cooperation	Establishment of the United Nations Environmental Programme and the Environment Fund.

1977	UNEP Governing Council Decision 87(V)	UNEP established the collaboration with the International Labour Organisation and other United Nations bodies concerned, and with the appropriate organizations of workers and employers, in the development of an action programme for the improvement of the working and living environment of workers in industry, including agriculture and other sectors.
1980	International Union for the Conservation of Nature and Natural Resources adopted World Conservation Strategy	The term "sustainable development" is used and its definition is given: "for development to be sustainable it must take into account social and ecological factors, as well as economic ones; of the living and non-living resource base; and of the long term as well as the short term advantages and disadvantages of alternative actions".
1983	UN General Assembly Resolution A/RES/38/161, Process of preparation of the Environmental Perspective to the Year 2000 and Beyond	Establishments of the World Commission on Environment and Development (Brundtland Commission), which later became an independent body of UN General Assembly.
1987	Report of the World Commission on Environment and Development "Our Common Future" (Brundtland Report)	The Report provided the definition of sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". The interrelation of all elements in sustainable development was demonstrated, and it was underlined that not only developing, but also developed countries need to address the problem.
1992	UN Conference on Environment and Development (Rio de Janeiro) Adoption of Agenda 21: A Programme of Action for Sustainable Development and the Rio Declaration on	Agenda 21 was adopted as non-binding action plan of 4 sections and 40 chapters: Section I: Social and Economic Dimensions (poverty, consumption, health, population, decision making); Section II: Conservation and Management of Resources for development (atmospheric protection, deforestation, fragile environments, biological diversity, pollution, biotechnology, radioactive waste). Section III. Strengthening the Role of Major Groups (children, youth, men, women, indigenous people, NGOs, local authorities, workers and employers).

	Environment and Development	Section IV. Means of Implementation (science, education, technology, international institution and financial support).
	Adoption of the Convention on Biological Diversity and of the UN Framework Convention on Climate Change	It was reaffirmed that sustainable development constitutes the integration of the economic, social and environmental pillars. Chapter 17 of Agenda 21 dealt with protection of the oceans, all kinds of seas, including enclosed and semi-enclosed seas, and coastal areas and the protection, rational use and development of their living resources. Educational issues are widely addressed, in particular in maritime context (paragraphs 17.6, 17.15, 17.17, 17.38, 17.93, 17.134).
1992	UN General Assembly Resolution A/RES/47/191, Institutional arrangements to follow up the United Nations Conference on Environment and Development	Commission on Sustainable Development was created mainly to monitor progress in the implementation of Agenda 21 and activities related to the integration of environmental and developmental goals throughout the United Nations system.
1995	International Court of Justice render the decision in Gabcikovo-Nagymaros Case (Hungary vs. Slovakia)	Establishment of the principle of sustainable development in international environmental law.
2002	UN Conference on Environment and Development, Johannesburg Adoption of the Johannesburg Declaration on Sustainable Development and of the Plan	The Declaration reinforced pillars of sustainable development - economic development, social development and environmental protection at the local, national, regional and global levels. The Plan addressed sustainable development of oceans and coastal areas. In accordance with Chapter 17 of Agenda 21, the Plan promoted the conservation and management of the oceans through actions at all levels, giving due regard to the relevant international

	of Implementation of the World Summit on Sustainable Development	instruments (§ 32-36). Education was names critical for promoting sustainable development (§ 116). Therefore, sustainable development was to be integrated into education systems at all levels of education (§ 121). Moreover, it was agreed to develop, implement, monitor and review education action plans and programmes at the national, subnational and local levels, as appropriate (§ 122).
2012	The United Nations Conference on Sustainable Development, Rio de Janeiro Adoption of political document "Future we want", endorsed by General Assembly Resolution A/RES/66/288	The Document stressed the crucial role of healthy marine ecosystems, sustainable fisheries and sustainable aquaculture for food security and nutrition and in providing for the livelihoods of millions of people (§ 113). Section on oceans and sea specifically addressed problems of capacity-building, biodiversity, maritime pollutions, invasive species, coastal erosion, ocean acidification and fertilization, destructive fishing practices, preserving of coral reefs and mangroves as well as encouraged conservative measures like marine protected areas. However, education or training are not mentioned (§ 158-177). Special section on education encouraged access and improvement of quality of education, urged to prepare people to pursue sustainable development, to integrate sustainability issues into curricula, to introduce special programmes, to provide relevant teacher training, to ensure appropriate learning outcomes as well as to implement practice of sustainable management (§ 229-255). The Conference launched development of a set of Sustainable Development Goals.

Appendix 3

SWOT analysis in regards to employment in the maritime industry[34]

SWOT analysis for seafarers

in regards to employment in the maritime industry

Strengths	Weaknesses
Work skills and knowledge (47 %) *communication, competence, experience, professional skills, and seamanship*	Work skills and knowledge (21 %) *communication skills, lack of education or knowledge, lack of skills, unskilled, competence or experience (skill such as nautical, dangerous goods, safety), English language, social skills*
Specific aspects of work (16 %) *freedom and long leave/vacation*	Away from home (21 %) *away from home and family, often for a (too) long time*
Community and culture (16 %) *friendship and love for the job/ship/sea*	Social conditions (14 %) *fatigue/work hours/rest periods, fear, stress*
Economic aspects, individual (12 %): *salary, wages*	Social skills, attitudes (13 %) *lacking team spirit or unwillingness to commit to the job*
International work (8 %): *travelling*	Employment (11 %) *duration of contract, low wages, a dirty image, too many inspections*
	Working conditions (10 %) *high workload and risky conditions/work environment*
	Isolation (9 %) *loneliness on board, both due to missing family and the on board conditions*
(116 answers)	(97 answers)

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[34] Source: KNOWME. (2012). *Future demand of maritime professionals in the maritime and port industry*. Retrieved August 30, 2013 from http://www.know-me.org/images/outputs/2.1%20future%20demand%20of%20maritime%20professional_v2.0_published.pdf.

Opportunities	Threats
Employment and career (30 %) *skills, development, life-long careers, possibility of shifting between sea and shore, growing market, globalization of the job, good work environment, travel possibilities, good wages*	International competition and unemployment (22 %) *competition for jobs, low-cost labour*
Future vessels (18 %) *innovation and development on ships (safer, more stable and more specialized), belief in IT and technology to decrease workload and improve communications*	Work skills and knowledge (15 %) *lack of skills, experience, knowledge and competence in general*
	Automation and efficiency (15 %) *reducing jobs and the economic crisis*
	Terrorism & international threats (13 %) *piracy*
Social conditions (15 %) *lack of seafarers*	Rules and regulations (13 %) *increasing (over) regulation*
Work skills and knowledge (15 %)	Safety and security (12 %)
Technology and ITIC (13 %)	Social conditions (10 %)
Salary (9 %)	
(80 answers)	(78 answers)

SWOT analysis for shore-based personnel

in regards to employment in the maritime industry

Strengths	Weaknesses
Work skills and knowledge (46 %) *competence, experience, and knowledge of seafarer life*	Work skills and knowledge (37 %) *lack of understanding of ships, on board challenges, seafarer life and conditions, lack of communication/cooperation, outdated knowledge or specialist knowledge*
Relation to maritime industry (15 %) *challenging industry, good image, opportunities, collaboration, change*	Relation to the maritime industry (21 %) *responsibility, regarding the maritime industry as isolated from other industries and being inflexible*
Specific aspects of work (12 %) *being at home, interesting/varying job, social benefits*	
Communication (11 %) *communication skills*	Working conditions (19 %) *stress, pressure, long work hours, high availability*
Economic aspects (9 %) *good pay/wages/salary*	Social conditions (16 %) *lack of motivation, disinterest, travelling*
International work (6 %)	Economic aspects (5 %) *wages*
(82 answers)	(63 answers)
Opportunities	**Threats**
Challenges at work (31 %) *change, specialization, flexibility, development and cultural skills*	Globalization and efficiency (27 %) *economic crisis, fewer jobs, lower wages, increased competition*
Market and competition (24 %) *emerging markets, development of ships, technology and IT*	Work skills and knowledge (25 %) *lack of skills and experience, especially concerning new technology*
International work and networks (20 %) *travel, internationalization, networking,*	International competition (15 %)
Attitudes to work (13%)	Work conditions (8 %) *high pace of work*
Social and economic aspects (9%) *good work-life, benefits, high salary*	Rules and regulations 8%
	Economic aspects (6 %)
	Environmental aspects (4 %)
(55 answers)	(52 answers)

SWOT analysis for port workers

in regards to employment in the maritime industry

Strengths	Weaknesses
Work skills and knowledge (42 %) *competence, understanding of people at sea, challenges, professional/skills, teamwork*	Working conditions (49 %) *dangerous or hazardous work environment, long work hours and/or shift, night work*
Specific conditions (18 %) *friendship, motivation, safe employment*	Social skills (21 %) *arrogance, lack of motivation or laziness*
Changes in work (16 %) *growth of transportation, the market and variation of work*	Work skills and knowledge (11 %) *lack of understanding of seafarers conditions*
Wages (12 %)	Communication (7 %) *English and general communication skills*
Communication (10 %): *English and general communicative skills*	Union (5 %)
	Market issues (5 %) *economic pressures*
(62 answers)	(57 answers)
Opportunities	**Threats**
Changes in the shipping industry (42 %) *development, change, specialisation, expansions, increased traffic, computerization*	Autom action and efficiency (27 %) *fewer jobs*
Work skills and knowledge (39 %)	Attitudes to the future work (24 %) *privatization, instability of the job market, increased demands for efficiency*
Working conditions (11 %) *safe workplace*	Safety and security (17 %)
Economic aspects (6 %) *salary*	Work skills and knowledge (12 %) *communication, English skills*
	Attitudes to work (5 %)
	Economic aspects (5 %)
	Unions (5 %)
(36 answers)	(41 answers)

Opportunities and threats for the maritime industry as a whole,

the shipping industry, shore based industry and for ports

Maritime Industry

Opportunities	Threats
Globalization and new market (42 %)	Economic crisis (51 %)
New technology (24 %)	Rules and regulations (20 %)
Environmental aspects (13 %)	Work skills and knowledge (14 %)
Training and education (13 %)	Piracy and accidents (6 %)
Attitudes to seafarers (7 %)	Environmental aspects (6 %)
	Culture aspects (4 %)
(55 answers)	(56 answers)

Shipping Industry

Opportunities	Threats
International market (44 %)	Economic issues and international competition (53 %)
Safety and technology (28 %)	
	Rules and regulations (18 %)
Training and education (14 %)	
	Environmental aspects (8 %)
Environmental aspects (10 %)	
	Piracy and accidents (8 %)
Rules and regulations (4 %)	
	Lack of trained employees (6 %)
	Work and cultural aspects (6 %)
(50 answers)	(62 answers)

Shore-based Industry

Opportunities	Threats
International market (38 %)	Economic crisis-negative effects (59 %)
Training and education (28 %)	Work skills and knowledge (21 %)
New technology (24 %)	Rules and regulation (9 %)
Environmental aspects (7 %)	Cultural aspects (6 %)
(29 answers)	(34 answers)

Ports

Opportunities	Threats
Efficiency and expansion (50 %)	Economic aspects (56 %)
New innovations and technology (18 %)	Competence and quality (12 %)
Training and skill (13 %)	Lack of service (9 %)
Rules and regulations (16 %)	Safety (9 %)
	Union regulations (6 %)
(38 answers)	(34 answers)

Strengths and weaknesses

the labour market for officers and ratings

Officers

Strengths	Weaknesses
Work skills and knowledge (71 %) *skill, knowledge, experience, seamanship, responsibility and reliability*	Working conditions and social factors (39 %)
Communication and language skills (9 %)	Costs and salary (35 %)
Social and cultural aspects (6 %)	Nationality and competition (13 %)
Identification and tradition (6 %)	Communication and language skills (6 %)
Working conditions (4 %)	Lack of experience (6 %)
Economic aspects (4 %)	
(85 answers)	(62 answers)

Ratings

Strengths	Weaknesses
Work skills and knowledge (59 %) *skill, knowledge, experience, seamanship, responsibility and reliability*	Costs and wages (41 %)
	Attitudes to work (22 %)
Attitudes to work (17 %)	Lack of training and education (17 %)
Communication and language skills (9 %)	Working conditions (9 %)
Cultural aspects (5 %)	Fewer EU-flagged vessels (7 %)
Shift and support system (5 %)	Lack of language knowledge (4 %)
(66 answers)	(54 answers)

Appendix 4

Competences for Master's Degree

in Sustainability Science and Technology

(Polytechnic University of Catalonia, Spain)

Competences

On finishing the master's degree, graduates will be able to:

Transversals competencies

Transversals competencies are those things that the graduate will be able to understand or do upon completion of the learning process, regardless of the specific course. **The transversals competencies established by the UPC** are: capacity for innovation and entrepreneurship, sustainability and social commitment, knowledge of a foreign language (preferably English), teamwork and proper use of information resources.

Specific competencies

o Critically and systemically analyse and assess development and sustainability theories, strategies and policies; different approaches to the sustainability paradigm, the issues involved and the environmental, social, cultural and economic implications; the particular characteristics of environmental economics and ecological economics; and problems related to the economic valuation of goods, services, resources and externalities.

o Apply knowledge of the evolution of societies, their impact on the environment, urban transition, and the main defining features of modern society. They will also be able to apply techniques and knowledge on the management of socio-environmental conflict.

- o Critically analyse and assess theories and approaches regarding the characteristics and properties of the geosphere and biosphere in order to facilitate and provide a framework for the development of socio-ecological systems and analyse the main challenges of climate change.

- o Show an effective and critical approach to meeting the challenges of sustainability and sustainable development by applying conceptual frameworks, processes and techniques for obtaining and processing data, applied statistics, mathematical models, systems analysis, geographic information systems, information and communication technologies and industrial ecology.

- o Critically analyse the characteristics, working methods, business management, environmental management and business strategies of organisations, institutions and key agents in the promotion of sustainable human development and for sustainability, environmental protection and climate change, based on knowledge and application of concepts and theories of business ethics and social responsibility in the fields of engineering and scientific and technical innovation.

- o Apply the methods and tools used in identification, information management, planning, management, execution and assessment of sustainability and environmental management programmes and projects. They will also be able to work in collaboration to solve specific problems.

- o Design, develop and apply, in an integrated and coordinated manner, concepts, theories and analysis techniques taken from the social sciences, economics and the earth sciences, as well as management techniques, action research methods and approaches based on sustainability science and technology in the fields of biodiversity, natural resources, the built environment, services, industry and information systems.

- o Coordinate, plan, develop and assess sustainable development programmes and sustainability strategies by identifying and strengthening the abilities of participants and considering local, national, European and international organisations, strategies and policies on this topic.

o Apply knowledge on integrated management of the natural environment and natural resources, especially hydraulic and energy resources, in the development and proposal of scientific and technological solutions to the challenges of sustainability.

o Develop advanced approaches for analysing and assessing the sustainability of the built environment, including building construction, infrastructure and transport, in order to minimise impact and select the most appropriate alternatives, in accordance with at least one of the three pillars of sustainability: the economy, society and the environment.

o Design, develop, apply and assess conceptual frameworks, theories, methodologies and techniques from the field of ICTs to promote sustainable development and sustainability.

o Apply and assess theories, approaches and methods for integrated valorisation in the fields of nutrition and rural development, agricultural engineering, water engineering, energy, building construction, construction, transport and spatial planning, and adopt a critical approach to analysing the results.

Source: Polytechnic University of Catalonia. (2013f). *Master's Degree in Sustainability Science and Technology*. Retrieved October, 1, 2013 from http://www.upc.edu/learning/courses/masters-degrees.

Appendix 5

Extract from the curriculum for Master's Programme

in Sustainable Science and Technology

(Polytechnic University of Catalonia, Spain)

Courses

o Fundamentals of Economics, Environmental Economics and Ecological Economics;

o Fundamentals of Engineering, Sustainability and Development;

o Fundamentals of Mathematical and Systemic;

o Sustainability Modelling;

o Fundamentals of Applied Statistics and Sustainability and Development Measurement;

o Fundamentals of Ethics, Business and Innovation;

o Fundamentals of Sustainable Management and Environmental Management Systems;

o Fundamentals of Social Sciences and Approaches to Socio-Environmental Conflicts;

o Research-Action Workshop on Sustainability Science and Technologies;

o Fundamentals of Geosciences and Geographic;

o Information Systems;

o Biodiversity and Socio-Ecological Systems;

o Water resources and infrastructure;

o Energy resources;

o Regional and Transport Infrastructure Metabolism;

o Urban Metabolism and Ecological Urbanism;

o Information and Communication Technologies;

o Industrial Ecology;

o Integral Management of Urban and Ecological Water Cycles;

o   Renewable Energy Technology;

o   Energy economy and comprehensive energy planning Models;

o   Energy Efficiency in Building Construction;

o   Funding transport infrastructure;

o   Sustainable Design of Products and Services;

o   Complex and Socio-Environmental Networks;

o   International cooperation and development;

o   Development cooperation projects.

Source: Polytechnic University of Catalonia. (2013b). *Master in Sustainability Science and Technology: Curriculum*. Retrieved October, 1, 2013 from http://www.upc.edu/gestioestudis/files/files_masters/308_p_ing.pdf.

Appendix 6

Curriculum for the course

"Sustainable Maritime Development"

(World Maritime University, Master of Science programme)

I. Title

Sustainable Maritime Development.

II. Rationale

The IMO Secretary General Koji Sekimizu has announced the World Maritime Day theme 2013 "Sustainable development: IMO's contribution beyond RIO+20" and has stated MET as one of the eight pillars around which sustainable maritime development goals are set. Moreover, during the 44th meeting of the Sub-committee on Standards of Training and Watchkeeping in April 2013 the Secretary General has announced that the Concept of sustainable maritime transport system is being drafted by the IMO Secretariat and to be published in September 2013.

Consequently, maritime administration will have a need for qualified personnel to implement this new international instrument on the national level. For this reason, it is important to introduce to the Marine Environment and Safety Administration Programme in the World Maritime University a new discipline Sustainable Maritime Development. The discipline also could be delivered as a professional development course independently by WMU or in collaboration with the IMO Integrated Technical Co-operation Programme.

III. The aim and learning outcomes

The *aim* of the course is to enhance the understanding of individuals about the complexity of sustainable maritime development by acquiring skills to enable achievement of sustainable maritime development goals in a national context.

Learning outcomes. On the successful completion of the course students should be able to:

a) understand and appreciate the importance of sustainable maritime development;

b) apply IMO documents of sustainable maritime development and other related international instruments;

c) analyse national context and apply different methods of its evaluation;

d) evaluate the important international and national maritime problems;

e) understanding of the notions of governance and stakeholders;

f) apply different models of sustainable maritime development;

g) prepare national policy and related documents on sustainable maritime development;

h) monitor the implementation and effectiveness of national policy on sustainable maritime development.

IV. Context

4.1. Learners:

- governmental officials, employees of maritime administration and related public agencies;

- no specific requirements on academic background and seagoing service;

- previous working experience in public administration is recommended.

4.2. Internal environment:

- a classroom equipped with white/black board and presentation equipment;

- layout of tables should be suitable for group activities;

- no specific facilities (laboratories, computer rooms) are required;

- printed could be limited, learning materials could be provided electronically;

- learning materials (a manual and hangouts) are to be developed by lecturers (the reference to this dissertation could be used);

- the course should be delivered after disciplines related to international maritime law and public administration;
- the course intake limitation 8 – 20 students.

4.3. External environment:

- World Maritime Day theme 2013 "Sustainable development: IMO's contribution beyond RIO+20" and opportunities to receive support from IMO;
- UNESCO Decade of Education for Sustainable Development (2004-2014);
- possibilities of collaboration with universities of Sweden;
- initiative comparing to programmes delivered in other MET institutions;
- corresponds to contemporary environmental trends in shipping;
- increased opportunities for sponsorship.

4.4. Lecturers:

- WMU academic staff qualified in the subject matter;
- invited experts on the IMO Strategy on Sustainable Maritime Development or national strategies.

V. Course outline

Day No[1]	Topic	Learning outcomes	Learning activities	Assessment / evaluation
Day 1	Introduction to the course and importance of sustainable maritime development Sustainable development and sustainable maritime development: definition, principles and history	III(a)	Ice-breaking session Lecture Buzz-groups	Not formal preparatory evaluation during ice-breaking session
Day 2	International legal documents in sustainable maritime development International, regional and national institutions	III(a) III(b)	Lecture	No assessment
Day 3	Selected current challenges in maritime industry and relevant case studies Discussion on national maritime issues	III(c) III(d)	Lecture Discussion	Non formal formative evaluation during the discussion
Day 4	Methods of evaluating national context and relevant case studies	III(c) III(d)	Lecture Work model	No assessment

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[1] For the Master of Science programme in WMU each day should have two sessions of 90 minutes (3 hours) per day and in total 30 hours of classroom activities in ten days. Delivering this material as a professional development course it could be presented in four 90 minutes sessions (6 hours) per day, in total 30 hours of classroom activities in 5 days.

Day	Topic	Learning outcomes	Method	Assessment
Day 5	Concept of governance Negotiation and cooperation with substantially interested stakeholders Brief presentation of the concept for a group project	III(e)	Lecture Role-play	Non formal formative evaluation during the presentation
Day 6	IMO Concept of a Sustainable Maritime Transport System	III(a) III(b) III(d)	Lecture	No assessment
Day 7	Implementation mechanism and interpretation methods Legal drafting techniques	III(b) III(c) III(f) III(g)	Lecture Group work	Non formal formative evaluation during the group work
Day 8	Sustainable development goals and criteria	III(g) III(h)	Lecture	No assessment
Day 9	Monitoring methods, amendments and recommendation Short individual discussion of a group project	III(h)	Lecture	Non formal formative evaluation during the discussion
Day 10	Presentation of a group projects	III(a) – III (h)	Presentation	Formal summative assessment
3 weeks	Evaluation of the national context and drafting the national policy on sustainable maritime development (introduction, selected chapter(s) and conclusion)	III(a) – III (h)	Written assignment	Formal summative assessment

VI. Recommended Curriculum Evaluation

Curriculum area under review	Criteria	Methods for collecting information	Source of information
Aim and objectives	Students' understanding and appreciation of aims and objectives Relation of aim and objectives to on-job requirements Motivation of students	Evaluation questionnaire documentary analysis, assessment analysis, interviews	Students, external evaluator
Content	Relation to on-job requirements Relation to goals of sustainable maritime development	Evaluation questionnaire, documentary analysis content analysis assessment results analysis	Students, external evaluator
Learning activities	Correspondence to concepts of education for sustainable development (for example: envisioning, complexity thinking, governance, stakeholders, role-play)	Evaluation questionnaire, documentary analysis, observation	Students, external evaluator
Assessment	Validity, reliability and practicality	Evaluation questionnaire, documentary analysis, assessment results analysis	Students, external evaluator

Appendix 7
Extracts from policies of MET institutions
related to sustainable development

Istanbul Technical University, Turkey:

"To develop a sustainable and scientific educational background in order to graduate environmentally conscious maritime officers with analytical, creative and contemporary thinking, strong social and leadership skills, who will work in national and international vessels/sectors as well as being able to conduct research, development and production activities on land if necessary.

To develop interdisciplinary education and research background in order to educate academicians who will contribute to knowledge and technology production and transfer, create positive impact on the national and international maritime sector while working under the guidelines of scientific, engineering and maritime ethics" (Istanbul Technical University, n.d.).

Tokyo University of Marine Science and Technology, Japan:

"To carry out basic and applied education and research activities related to studies and to science and technologies concerning oceans, with a view to contributing to sustainable development of human society" (Tokyo University of Marine Science and Technology, n.d.).

Svendborg International Maritime Academy, Denmark:

"SIMAC wishes to promote sustainable development by implementing environmental considerations into day-to-day operations. SIMAC wishes to achieve the goal of reducing wastage and focusing on energy efficiency.

SIMAC wishes to help the environment by demanding eco-friendly products and services from suppliers and partners.

At SIMAC, everyone is aware of the consumption of resources, and everyone contributes to conserving resources, for example in the areas of energy, transport and paper, and is thus focused on reducing greenhouse gas emissions.

We sort and dispose of waste in an eco-friendly manner in an effort to reduce the environmental impact. Paper and batteries are collected for recycling. Paper for recycling should be deposited in bags and bins marked for this purpose. Batteries can be deposited in bins at the janitors' office (the men in black)." (Svendborg International Maritime Academy, 2013, p. 20).