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MSc Dissertation:

Blue Growth and the Monetary Valuation of the Multi-Use Offshore Platforms

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Abstract

The purpose of this dissertation is to examine the goals of European Union's objective of Blue Growth, which is 'EU's long term strategy to support sustainable growth in the marine and maritime sectors' (COM, 2012) and to conduct a monetary valuation of the Multi-Use Offshore Platforms. Specifically, this study is conducted on the Mediterranean Site of the MERMAID project: ''Innovative Multi-purpose offshore platforms: planning, design & operation'', which is one of three EU-FP7 funded projects selected for funding in response to Ocean 2011 on Multi-Use Offshore Platforms (FP7-OCEAN.2011-1 "Multi-Use Offshore Platforms"). A Benefits Transfer method is implemented so as to derive the people's willingness to pay towards the potential of a Multi-Use Offshore Platform at the area. This research is part of the Environmental Impact Assessment and the Social Cost Benefit Analysis of the Mermaid Project and contributes to the monetary valuation of the Multi-Use Offshore Platforms.

Key Words: Blue Growth, Mermaid project, Multi-Use Offshore Platforms, Non-market valuation, Benefits Transfer Method

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Introduction

Considering the fact that more than 70% of the earth's surface is covered by oceans and seas, much of which is either underexplored or unexplored for the time being, it comes as a natural question what could be the potential of this environmental good and how it could contribute to the welfare of the human being. Moreover, as far as the European territory is concerned, 23 of the EU Member States have coastal territory and two thirds of the European borders are set by the sea, which can be translated into important potential from maritime and economic activities. Therefore the European Union's objective of Blue Growth is to support sustainable growth in the marine and maritime sectors' (COM, 2012); since it is believed that the marine factor can have an important role for long-term development.

Additionally, there is the belief that oceans and seas can contribute significantly to major present and future challenges such as the global warming, the climate change and the globalization. As a consequence, it is comprehended that it is necessary to create the correct mechanisms in order to take advantage of all this marine potential, but in a sustainable and smart way. EU'S Blue Growth Strategy considers that, in order to achieve this goal, maritime economic activities need to be combined and that innovation is a key factor. Regarding these innovative synergies, The Mermaid Project: Innovative Multi-purpose off-shore platforms: Planning, Design and Operation (FP7-OCEAN-2011) will provide important information on the economic and environmental feasibility of Multi-Use Offshore Platforms around Europe, concentrating on four different study sites: the Mediterranean Sea, the Atlantic Sea, the North Sea and Wadden Sea and the Baltic Sea. Apart from conducting a thorough review of the Blue Growth Strategy, this dissertation also explores the Mediterranean Site of the Mermaid Project, conducts a monetary valuation of the environmental externalities of the Multi-Use Offshore Platform (MUOP) through the Benefits Transfer Method and is motivated by the research question: How could the Multi-Use Offshore Platforms promote the Blue Growth Strategy implementation?

A. Blue Growth

As already mentioned in the introduction, the EU Blue Growth Strategy (2012) is a long term initiative to support sustainable growth in the marine and maritime sectors. Water covers the 71% of the earth's surface[1] and the 'blue' economy represents roughly 5.4 million jobs and generates a gross added value of almost €500 billion a year. Consequently, European seas and oceans are vital to the Union's economy with great potential for innovation, economic growth and job creation. The Blue Growth Strategy is the Integrated Maritime Policy's contribution in order to help achieving the goals of the European Union's ten-year growth strategy called Europe 2020[2] for smart, sustainable and inclusive growth. EU co-funding programmes such as Structural and Cohesion Funds (like INTERREG and Smart Specialisation), Horizon 2020, the European Maritime and Fisheries Fund (EMFF) and the EU Atlantic Action Plan (2014-2020) facilitate the implementation of the Blue Growth Strategy (O'Reilly, E., et al. 2013).

I. The Integrated Maritime Policy of the European Union

The European Commission (2007) decided to put in place an integrated, horizontal and cross-sector maritime policy, encompassing all aspects of the human relationship with the seas and oceans as an attempt to protect the maritime resources. Such an action was deemed necessary, firstly, because of the inter-connectedness of industries and human activities connected to the sea. A decision in one sector may have an effect on the others.

In addition, it has an economic added value, because it encourages the authorities to cooperate and share the available data across policy fields rather than working separately on different aspects of the same problem. It also encourages the decision-makers of government – national maritime authorities; regional, local and international authorities; and international authorities - to work closely both inside and outside the barriers of the Union.

[1] http://ec.europa.eu/maritimeaffairs/policy/blue_growth/infographics/
[2] http://ec.europa.eu/europe2020/index_en.htm

As far as the objectives of the policy are concerned, the main one is to ensure the competitiveness, safety and security of the sector. In other words, it focuses on maximizing the sustainable use of the oceans and seas while promoting the development of the maritime economy and coastal regions. This can be achieved in several ways such as by creating a strategy to alleviate the consequences of climate change in coastal regions; issuing guidelines on the application of environmental legislation relevant to ports and proposing a new ports policy taking account of the multiple roles of ports; supporting international efforts to reduce pollution of the atmosphere and greenhouse gas emissions attributable to ships; and enhancing professional qualifications and studies in the maritime field to offer better career prospects in the sector. The cooperation between the coastguards and all the relevant national agencies creates a transnational network for maritime surveillance that ensures the safe use of the sea and the security of the European maritime borders.

A second goal of the integrated approach is to create a knowledge and innovation base for the maritime policy. The fields of marine science, technology and research analyze the effects of human activity on marine systems and suggest solutions to prevent environmental degradation and the effects of climate change. This means that the marine scientific community collaborates with the industry and policy makers. This collaboration with the creation of a complete and accessible source of data and information on all maritime activity facilitates the strategic decision-making on the specific issue.

Another objective of the maritime policy is to raise the life quality in coastal and outermost regions, reconciled with economic development and environmental sustainability. This can be achieved by developing the maritime potential of these regions, encouraging the coastal tourism and funding for maritime projects and coastal regions. While this objective concerns mainly the Member States who have competence in this field, a Union commitment is essential to manage effectively the coastal zone- both land and sea- and enable maritime spatial planning.

The EU intends, moreover, to promote its leading position in the international maritime affairs. An integrated policy facilitates the management of maritime affairs and the creation of EU priorities in this field. This is of particular importance given the global character of the problems encountered by the maritime sector. So, via the international agreements, the partners will ratify and apply the relevant instruments.

Finally, the Union by establishing an integrated maritime policy is raising her visibility and improving the image of this sector's activities and professions[3]

The Integrated Maritime Policy (COM, 2012) focuses on issues that both do not fall under a single sector-based policy and require the coordination of different sectors and actors. In detail, it covers the following cross-cutting policies:

- ***Blue growth*** - this strategy supports the sustainable growth of the oceans, seas and coasts. The sectors it includes are the renewable energy, the mineral resources, the biotechnology, the aquaculture and the coastal and maritime tourism.

- ***Marine data and knowledge*** - this strategy integrates the various national and local maritime systems with special focus on fisheries, the environment, transport, research, enterprise and industry. In that way, the development of new products and services by industry, public authorities and researchers in enabled.

- ***Maritime spatial planning*** - this framework aims to manage the high competition for maritime space and especially for renewable energy equipment, aquaculture and similar growth areas. It increases cross-border cooperation and creates synergies between different activities and records when and where human activities take place at sea in order to ensure that these are as efficient and sustainable as possible. The stakeholders are involved in a transparent way in the planning of maritime activities. This early identification of impact and opportunities for multiple use of space protect the natural resources of being exhausted.

- ***Integrated maritime surveillance*** - this policy tries to provide the authorities that engage in maritime surveillance (like border control, safety and security, fisheries control, customs, environment or defense) with ways to exchange information and data. In this way, the surveillance is cheaper and more effective.

- ***Sea basin strategies***[4] [5] [6] - this structured framework of cooperation between national European and third countries authorities that share a sea basin in relation

[3] European Commission, http://ec.europa.eu
[4] http://www.balticsea-region-strategy.eu/attachments/article/590684/Macro%20regional%20-%20Sea%20basin%20-%20What%20is%20what.pdf
[5] http://www.adriatic-ionian.eu/
[6] http://epthinktank.eu/2013/09/28/european-unions-macro-regional-strategies/

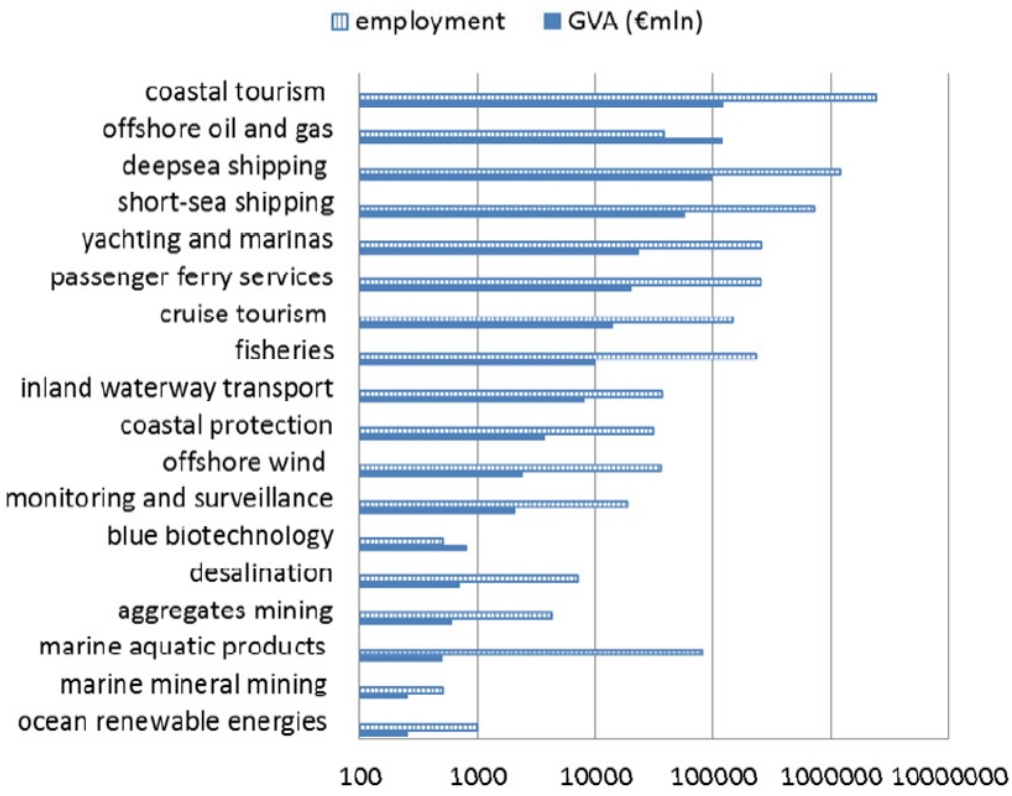
to a given geographical area. A sea basin strategy takes into account the geographic, climatic, economic and political specificities of the specific sea basin, because each sea region is unique and merits a tailor-made strategy. For each large sea region in the Union, there is a specific policy that promotes growth and development strategies that exploit its strengths and address its weaknesses.

II. Key factors of the Blue Growth Strategy

The Commission estimates[7] that the profit of coastal and maritime tourism is about 51 million Euros while the employees we more than 1,6 million people. Also, the employees of the fisheries reach the 732.000 and the ones of the aquaculture reach the 90.000. In total, three quarters of Europe's external trade and 37% of trade within the EU is connected to the sea. This activity is concentrated mainly around the coasts, but it is not limited there, given that some important manufacturers of marine equipment are based on landlocked countries (COM, 2012).

The ports and coastal communities have always been centers for new ideas, innovation and welfare, thanks to their outward-looking geography. Apart from this capacity innovation, three new factors have contributed to their development. First, the fast-moving technological progress has facilitated the offshore work in ever deeper waters. As a result, robotics, video-surveillance and submersible technology are nowadays routinely used for operations that were not feasible in the past.

[7] http://ec.europa.eu/maritimeaffairs/policy/blue_growth/infographics/



Employment and economic size of marine and maritime economic activities
Source: COM, 2012

Second, people start getting aware that both land and freshwater are limited resources, and, mathematically further clearing of forests or draining of wetland will deprive future generations of their benefits. So, one of the basic environmental target should be the usage of the ocean so that it can deliver human needs such as food and energy in a more sustainable way.

Third, the urge for reduction of the gas emissions of the greenhouses has favored the deployment of offshore renewable energy installations. In the meantime, it has also provided a further incentive for energy saving, as well as a reason to promote seaborne transport, since it presents lower emissions per tonne-kilometre compared to land transport. The constant improvement of the energy efficiency of the ships will help reduce these emissions which account for about 3% of the total greenhouse gas emissions.

The above mentioned factors have opened up the opportunity for blue growth – ‘’an initiative to harness the untapped potential of Europe's oceans, seas and coasts for employment and growth’’(COM, 2012). It is believed that growth in the blue economy may offer new and innovative ways to help lead the Union out of the current

economic crisis. Representing the maritime dimension of the Europe 2020 strategy, it has placed the blue economy firmly on the agenda of Member States, regions, enterprise and civil society; it can contribute essentially to encourage the EU's international competitiveness, resource efficiency, job creation and new sources of growth while preserving the biodiversity, the marine environment, and the marine and coastal ecosystem services.

III. Blue Economy and Innovation

The Blue Growth can also be described as the growth in the Blue Economy whose vision is to support companies and entrepreneurs that create more from less. As such, it stands for a new way of designing business: using the resources available in cascading systems, where the waste of one product becomes the input to create a new cash flow. Blue Economy supports these innovations and offers them a platform with the scope of controlling the human production and consumption patterns that tend to be no longer sustainable. It is believed that, it is possible to create a system where the good and innovative is affordable.[8] . The European Commission also uses the term of blue economy to refer to several maritime activities. Among the various opportunities for marine and maritime sustainable growth, jobs are created, social capital is built and income rises – while the environment that provides the basis for life is no longer strained and polluted. Blue Economy involves:

- Mature activities, such as short-sea shipping, offshore oil and gas, coastline tourism and coastal protection.
- Activities in their growth stage such as marine aquatic products, offshore wind, cruise shipping and maritime monitoring and surveillance.

Also it includes the newly emerging maritime economic activities in so-called pre-development areas, such as the blue biotechnology, the ocean renewable energy and the marine minerals mining. The individual sectors of the blue economy are interdependent and rely on common skills and shared infrastructure such as ports and electricity distribution networks both in EU level and in cooperation with third countries. Thus, innovation across all sectors of the blue economy is crucial to pursue the growth and jobs potential and can also bring environmental benefits.

[8] http://www.blueeconomy.eu/

On May 2014, the European Commission presented[9][10] an Action Plan for Innovation in the 'Blue Economy' to help use ocean resources sustainably and drive growth and jobs in Europe. The blue economy has over 5 million people employed in blue sectors such as coastal and maritime tourism, shipbuilding and fisheries, and it could grow further and employ 7 million by 2020. However, since fresh water and land have already started being inadequate due to the growing world population, it is essential to explore oceans 'potential for food, medicine and energy needs. The blue economy has the potential of creating more jobs and consequently human economic growth. It is crucial that human activities become sustainable so that future generations can also enjoy the same quality of life and environment as today[11].

IV. European Union's Initiatives

There have been a significant number of EU policies with the scope of reinforcing the efforts of Member States and regions and providing common building blocks for a successful blue economy. Among these, there are:

- The **Marine Strategy Framework Directive**[12] The EU launched this directive, in June 2008, with the purpose to assure sustainability in marine exploitation. The MSFD requires the achievement of a "Good Environmental Status" (GES) by 2020, and the GES refers to the EU marine waters. It is declared that Members States must undertake only cost-effective measures in the implementation of MSFD and therefore an ecosystem-based approach and a cost-benefit analysis of suggested measures are required.
- The "**Water Framework Directive"** (WFD), produced by the EU, September 2000, is a general framework regarding the water status of river basins and associated coastal areas. The WFD's main target is to achieve a "good environmental status" (GES) for all European waters by 2015, in its first implementation (2009-2015). The WFD is characterized also as potentially groundbreaking legislation (Moss B., 2008)It is considered to be quite complex, but still remains a very important legislation since it ''enforced'' that Member states to

[9] http://europa.eu/newsroom/calendar/events/2014/05/08-blue-economy_en.htm
[10] http://ec.europa.eu/information_society/newsroom/cf/mare/itemdetail.cfm?item_id=16434
[11] http://www.eubusiness.com/topics/fisheries/blue-economy
[12] http://ec.europa.eu/environment/marine/index_en.htm

produce the River Basin Management Plans in order to facilitate the concept of precise water management.

- The "**Marine Knowledge 2020**"[13] initiative aims to provide an integrated knowledge infrastructure based on data collection systems of every country delivering data products at a European-level through the internet. There are expectations of benefits of at least €500 million a year through increased efficiency and innovation.
- The **Common Information Sharing Environment (CISE)**[14] for the surveillance of the EU maritime domain. CISE will allow maritime authorities that are responsible for several marine activities to share information on potential risks and threats. As a result, the cost and the risk to businesses operating at sea will be decreased.
- The **European Maritime Transport Space without Barriers**[15] intends to clarify administrative procedures for maritime transport. The goal is that subsequently, it will emerge as a 'Blue Belt' of free maritime movement in European territory.
- The **Europe 2020** is a 10-year strategy proposed by the European Commission on the 3rd of March 2010 and it aims at "smart, sustainable, inclusive growth" with greater coordination of national and European policy. The Europe 2020 Strategy[16] for smart, sustainable and inclusive growth, consider achieving by 2020, five headline targets and seven flagship initiatives. The Europe's 2020 headline targets include employment, research and development, climate/energy, education, social inclusion and poverty reduction and the group of seven flagship initiatives constitute the supporting framework. The priorities referred are innovation, digital economy, employment, youth, industrial policy, poverty and resource efficiency. The EU demonstrates the meaning of energy sector by introducing in 2010 the "Energy 2020" strategy, in the framework of "Europe 2020 for smart sustainable and inclusive growth" strategy, which sets the "20-20-20" targets. First, the reduction of greenhouse gas emissions by 20%, second the increase of the renewable energy share to 20% and third, the achievement of 20% energy efficiency by 2020.

[13] http://europa.eu/legislation_summaries/environment/general_provisions/ev0025_en.htm
[14] https://www.iit.demokritos.gr/project/eu-cise-2020
[15] http://ec.europa.eu/avservices/video/player.cfm?ref=I067277

- An initiative of great importance is the **Horizon 2020.** It is the biggest EU Research and Innovation programme ever with nearly 80 billion Euros of funding available over 7 years - from 2014 to 2020. The program coordinators will also try to attract private investors. This initiative promises more breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market. Horizon 2020 is the financial instrument implementing the Innovation Union[17], an initiative that belongs to the general program Europe 2020[18] and aims at securing Europe's global competitiveness. The Union agreed that research is an investment in our future and so it is seen as the base for smart, sustainable and inclusive growth and jobs. By coupling research and innovation, Horizon 2020 is helping to achieve this with its emphasis on excellent science, industrial leadership and tackling societal challenges. The objective is to make the research opportunities more insightful and to increase synergies between different programmes, which can accelerate the uptake of new ideas by industry and will help ensure that public research funding pays off through innovation by business. The program is open to everyone, with a simple structure that reduces red tape and time so participants can focus on what is really important. The Horizon 2020 will target research and innovation on food security (i.e. aquaculture), clean energy (i.e. ocean energy and offshore wind), green transport (i.e. shipping), information technology (underwater cables and navigation), climate action and resource efficiency, as well as cross-thematic marine and maritime research.

About one third of the innovations planned have already been implemented in companies around the globe, one third is in prototyping status and one third has been scientifically proven but requires further research to create market-ready products. They all act as examples of the overall vision and philosophy of Blue Economy.

[17] http://ec.europa.eu/research/innovation-union/index_en.cfm
[18] http://ec.europa.eu/europe2020/index_en.htm

V. Blue Growth Target Areas

An analysis of the Blue Growth potential[19] has proved that there are five value chains able to deliver sustainable growth and employment in the blue economy. The Union could therefore gain from clear-sighted policymaking, and the private sector to play an important role so that the blue economy can reach its sustainable growth potential. Therefore, the five priority areas for large and complex cross cutting initiatives are the following:

Blue energy - Marine energies has a lot of abilities. It can augment the efficiency of collecting the European energy resource, reduce land-use requirements of the power sector and decrease the European greenhouse gas emissions. Blue energy - or ocean energy- technologies are currently being developed to harvest the renewable energy of our seas and oceans other than offshore wind. The development of this emerging sector would help achieve renewable energy and greenhouse gas reduction targets, and it could fuel economic growth through innovation and create new, high-quality jobs[20].

The Commission is focusing on the ocean energy sector because now it is an infant industry. Wave and tidal stream technologies can be better developed like other technologies. With technological improvements and additional public support to be given in line with guidance for the design of renewable support schemes for early stage development, the ocean energy sector may be able to grow to a similar scale as offshore wind. Ocean energy has also the potential to create new, high-quality jobs. Indicative job estimates from the impact assessment show that 10,500-26,500 permanent jobs and up to 14,000 temporary jobs could be created by 2035[21]. The ocean energy resource available globally exceeds our present and projected future energy needs. In the EU, the highest potential for the development of ocean energy is on the Atlantic seaboard, but potential also exists in the Mediterranean and the Baltic basins and in the Outermost Regions.

Maritime, coastal and cruise tourism- European coasts have a wide range of facilities and activities to offer, and as a consequence they are much preferred as a

[19] http://ec.europa.eu/research/bioeconomy/pdf/16-blue-growth_en.pdf

[20] http://ec.europa.eu/maritimeaffairs/policy/ocean_energy/index_en.htm

[21] http://www.renewableuk.com/en/publications/index.cfm/wave-and-tidal-energy-in-the-uk-2013

holiday destination. The maritime and coastal tourism sub-sector represents the sector with the largest single maritime economic activity. More than 2.35 million people, which are equivalent to 1.1% of total EU employment, work in this sector. Moreover, it is certain that a healthy environment is necessary for 'blue' tourism and aids the growth potential of new forms of tourism. From an ecosystem service point of view, high quality bathing waters and immaculate coastal and marine habitats display a high recreation value. As a consequence, coastal areas become even more attractive which in turn increases the growth potential of activities such as nautical tourism and sports, and green tourism such as whale watching. In order to promote the high-value tourism, the Commission attempts to apply cross-border coordination as part of a sea-basin strategy and to handle several issues with the small and medium enterprises.

Aquaculture - It refers to the breeding, rearing, and harvesting of plants and animals in all types of water environments including ponds, rivers, lakes, and the ocean. According to the U.N. Food and Agriculture Organization[22] fish accounts for about 15.7% of the animal protein consumed globally. Aquaculture has a growth rate of 6.6% per annum, which makes it the fastest-growing animal-food-producing sector. It also contributes to a general enhancement in human diet. In Europe, aquaculture accounts for about 20% of fish production and is renowned for its high quality, sustainability and consumer protection standards. EU growth in the sector is stagnant since 2000 whereas global production has been growing at nearly 7% per year. More than 90% of aquaculture activities in the EU are SMEs, providing more than 80000 jobs. Aquaculture can provide quality merchandise to consumers willing to select fresh, trustworthy products, and increase the quantity of sustainably or organically produced fish. Moreover, it can help coastal communities diversify their activities while alleviating fishing pressure and thus helping to preserve fish stocks[23]. In practice, the Common Fisheries Policy reform and the Strategic Guidelines of the Commission intend to boost this sector by reducing administrative burdens, improving access to space and water, increasing competitiveness and exploiting competitive advantages due to high quality, health and environmental standards.

[22] http://trashpatch.org/_/home.html

[23] http://www.easonline.org/

Marine mineral resources - Natural gas and oil have been extracted from the seas for decades, but the ores and mineral deposits on the sea floor have attracted little interest[24]. Yet as resource prices rise, so too does the appeal of ocean mining. Between 2000 and 2010 there has been an annual increase of about 15% in the price of many non-energy raw materials, mainly as a result of consumer demand in emerging economies (Kathijotes et al. 2013). Most current activity is in shallow water. By 2020, 5% of the world's minerals, including cobalt, copper and zinc could come from the ocean floors. This could rise to 10% by 2030. Global annual turnover of marine mineral mining can be expected to grow from virtually nothing to €5 billion in the next 10 years and up to €10 billion by 203030.t The International Seabed Authority (ISA) is responsible for organizing and controlling activities, including monitoring all mineral-related activities. This includes protecting the marine environment in line with the provisions of the UN Convention on the Law of the Sea (UNCLOS), to which the EU and all its Member States are contracting parties.

The recently launched Partnership will promote innovation along the entire value chain of raw materials and will represent a significant step for the EU in regaining a major role in securing a sustainable supply of raw materials, as well as ensuring and maintaining its competitiveness in the global mining market. The European Innovation Partnership for Raw Materials[25] (EIP) LAUNCHED in 2014 promotes the development of joint strategies by the Member States and other stakeholders (like companies, NGOs, researchers) in order to combine capital and human resources and ensure the implementation and dissemination of innovative solutions within Europe.

Blue biotechnology - The underwater world includes marine organisms other than fish and shellfish that provide data to the blue economy, partly through new gene sequencing technologies for living organisms. Exploration of the biodiversity of the sea has revealed information that could be used to develop new industrial enzymes or pharmaceuticals. Also, algae are being studied as a source of biofuels. The current employment in the sector in Europe is still low, but it is believed that by 2020, it could grow as a medium-sized market, and move to the production of metabolites and primary compounds (lipids, sugars, polymers, proteins) as inputs for the food, feed and chemical industries. In the future, the blue biotechnology sector could become a

[24] http://worldoceanreview.com/en/

[25] http://www.criticalrawmaterials.eu/

provider of mass-market products and of high added value specialized products. It would be necessary to develop a strategic approach towards research and innovation in order to acquire the scientific and technological bases that the emerging industrial sectors need. A European approach could raise awareness among policy makers, investors and the general public on the possibilities of marine aquatic products.

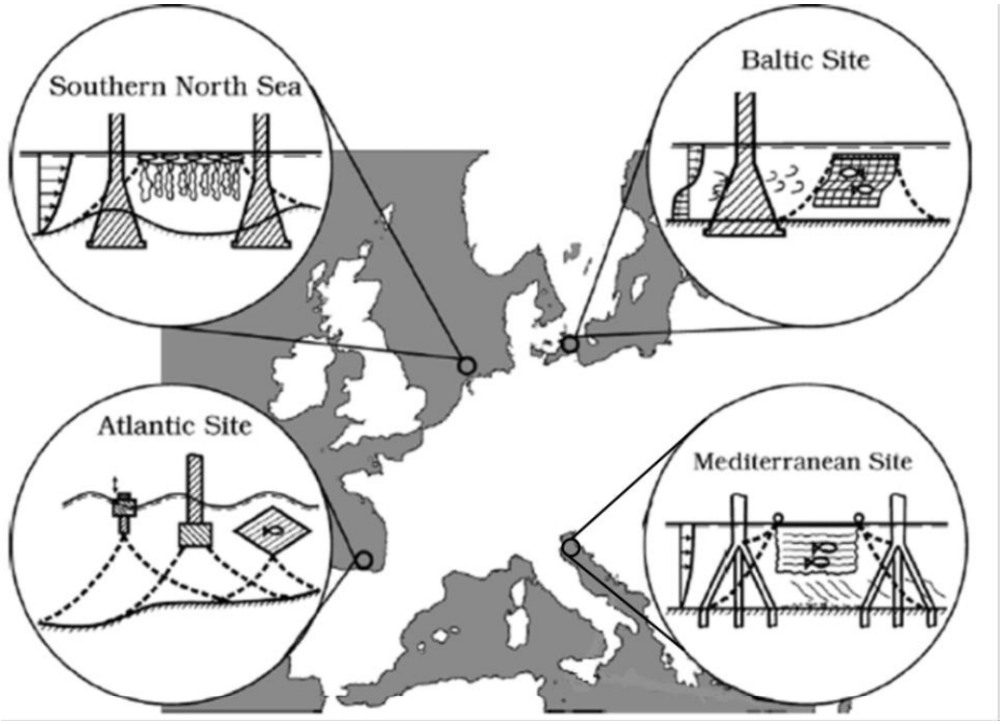
B. The Mermaid Project: Innovative Multi-purpose off-shore platforms: Planning, Design and Operation (FP7-OCEAN-2011)

The idea of the Innovative Multi-purpose off-shore platforms: planning, Design and Operation (MERMAID) project is to develop a new perception for a next generation offshore platforms for multi-use of ocean space for energy production, aquaculture and platform related transport, applying also at one of the key factors of the Blue Growth Strategy, the innovation. MERMAID is one of three EU-FP7, Seventh Framework Programme, funded projects selected for funding in response to Ocean 2011 on Multi-Use Offshore Platforms (FP7-OCEAN.2011-1 "Multi-Use Offshore Platforms"). This project shall have a cost of 7,4 million euro and the European Union has granted a financial contribution of 5,5 million euro. MERMAID, is consisted of 28 partners (Universities (11), Research institutes (8), Industries (5) and Small and Medium Enterprises (4 SME's), from many regions in EU). In the project group, there are experts in hydraulics, wind engineering, aquaculture, renewable energy, marine environment, project management as well as socio-economics. The objective of the project is not the actual building of new platforms, but the exploration of different concepts in design, such as a combination of structures or different uses on representative sites under different conditions. MUOPs are offshore platforms that combine multiple functions within the same infrastructure; they are designed for multi-use of ocean space for energy extraction (wind power production and wave energy), aquaculture and transport maritime services. The main goal of MERMAID is using technology in a way that will enhance economic feasibility, reduce environmental impact and increase the optimal use of available ocean space at specific sites.

The MERMAID project has selected four case studies, in four different natural environments, from deep water (Atlantic Site), to shallow water with high morphological activity (the Wadden and North Sea), and to inner waters like the inner Baltic Sea and the Mediterranean Sea. These areas were chosen to represent different marine environments, socio-economic conditions, data accessibility which will allow developing, testing and integrating different technologies through innovative coupling of various activities and services. As a result, the MERMAID

project shall produce recommendations and guidelines for the development, operation and exploitation of multi-use platforms (MUOPs) in each case study and in the EU in general. (Koundouri et al.,2013 ; MERMAID D7.2, 2014)

Map of Europe with close-up at the Four MERMAID Sites



Source: MERMAID D7.2, 2014

Environmental Characteristics, Design Types and Specific Issues in each MERMAID Site.

Site, Sea	Environmental characteristics	Design type	Specific issues
Krieger flaks, Estuarine site, Baltic sea	• Cold brackish waters with optimum salinities for temperate fish • Location on the pathway for exchange flow between Baltic	• Steel driven monopoles or gravity based turbine foundations • extensive mariculture	• Dredging • Mariculture spills • Sandmining in the area

	proper and the North Sea • high wind energy potential		
North Sea	• Waters with optimum salinities, temperate and nutrients for seaweed • Area where there is exchange of sediment between the North Sea and the Wadden Sea • high wind energy potential	• gravity based turbine foundations • extensive aquaculture	• Economic feasibility • Scour and backfilling processes • Environmental impact
Ubiarco and Santoña, Far Offshore area, Atlantic Ocean	• Very high wind energy potential • Very high wave energy potential	• floating platform (100 m depth) • multiple energy converters, i.e. wind and waves	• grid connections • mooring systems
Acqua Alta platform, Venice, Mediterranean Sea	• moderate wind energy potential • moderate wave energy potential	• gravity based foundations (16 m depth) • multiple energy converters, , i.e. wind and waves • algae culture	• Grid connections • Mooring systems • Environmental impact • Biodiversity • Economic feasibility

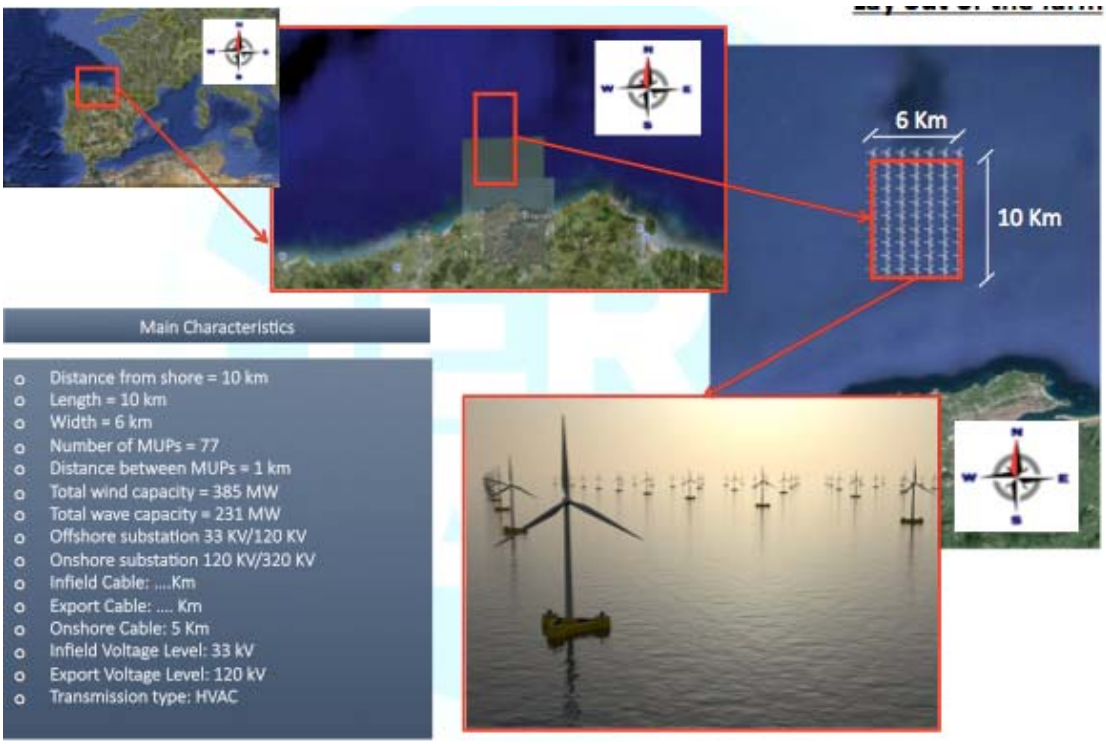
Source: MERMAID D7. 2, 2014

I. Short Description of the study sites

Atlantic Site

The location of the Multi-Use Offshore platform in the Atlantic Ocean is the Bay of Biscay and specifically in the offshore area of Cantabria, which is named by the MERMAID project experts "Cantabrian Offshore Site" (COS). The site is characterized "challenging" because of the fact that it presents very hard wind and wave conditions (D 7.1, 2013). The site is chosen without this offshore area being subject to any environmental, cultural, political or infrastructure theme. It is also observed that "the closest area is an unpopulated area with gravel and rocky beaches and small cliffs" (D 7.1, 2013). In the Atlantic site, the MUOP will only consist of wind and wave energy infrastructure, since the water conditions were not considered appropriate for aquaculture (MERMAID D7.2, 2014).

Layout of the platform in the Atlantic Sea

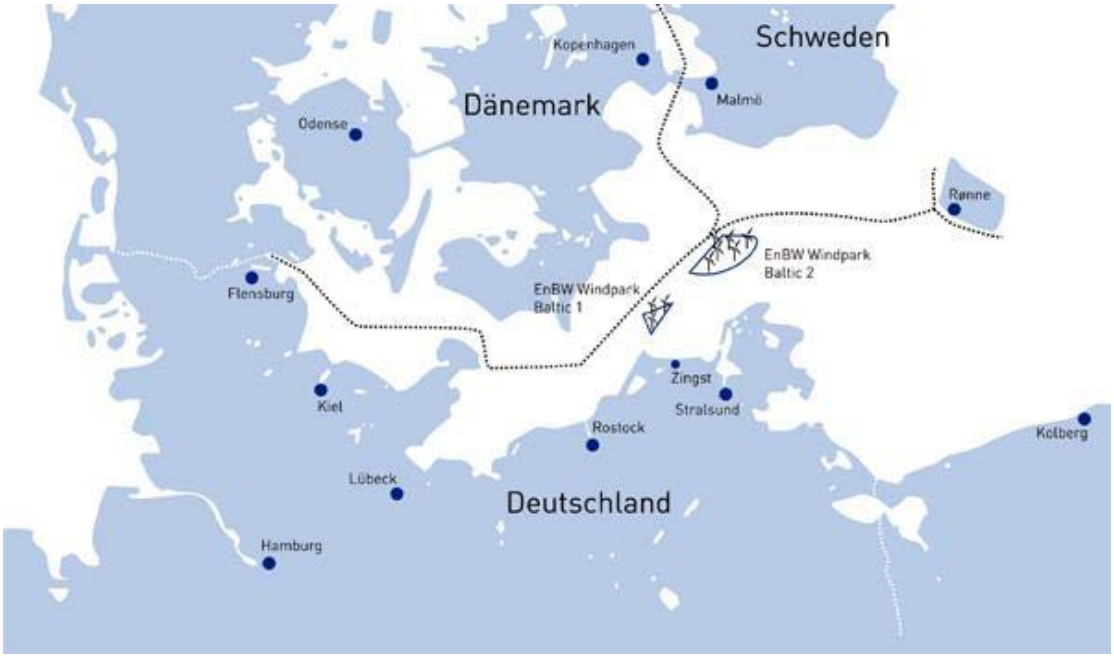


Source: MERMAID D7.1, 2013

Baltic Sea Site

The Kriegers Flak, at the marine area of Baltic Sea is the selected MERMAID Baltic Study Site. It is a ‘’large sandy shoal with a sand layer thickness of up to 8 m’’ located in the Western Baltic Sea between Denmark, Sweden and Germany. The MUOP in the Baltic Sea case study is designed to have an offshore wind farm of 600 MW, which is planned to be fully operational in 2020.This platform has been also examined for additional uses, like aquaculture of fish (rainbow trout and/or Atlantic salmon), seaweed and shellfish farming, in combination with the planned off-shore windmill farm. (MERMAID D 7.2, 2014)

Placement of the decided German Wind farm Baltic 2 at Krigers Flack



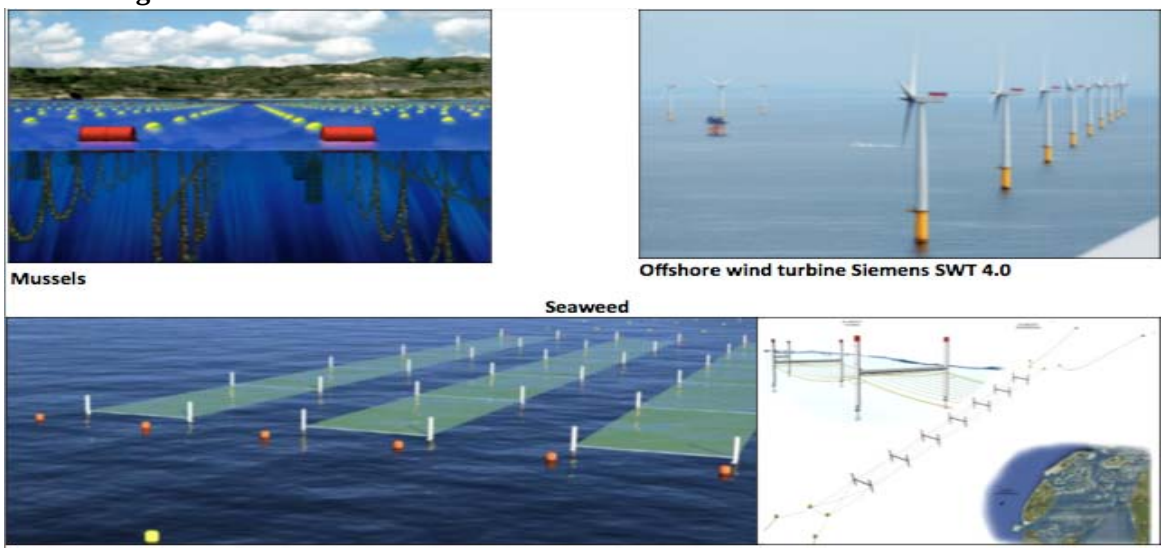
Source: MERMAID D7.1, 2013

North Sea Site

The MUOP case study is located in the North of the Netherlands, north of the Wadden Sea, above the Wadden Sea Islands, in an already licensed site to develop offshore wind farm, named Gemini. Although in The Netherlands no permits of multi use have been granted so far, the MERMAID project is also developing multi-use designs because stakeholders have shown their interest (MERMAID D 7.1, 2013). The MERMAID project alternative designs will include uses and activities like wave

energy convertors, electricity connection, aquaculture, especially fish farming, mussel and seaweed production, as well as an offshore hotel and support center.

Design of the 3 Individual Functions



Source: MERMAID D7.1, 2013

Offshore hotel and support center

Source: MERMAID D7.1, 2013

II. Mediterranean Study Site Description

As far as the Mediterranean Site is concerned, the MUOP is designed to be close to the Acqua Alta monitoring platform (Coordinates: latitude: 45°18'51'' North; longitude: 12°30'30'' East), because of the fact that there are a lot of met-ocean and physical information available. The Acqua Alta monitoring platform (a four leg framed template extending 4 m above the sea surface which operates as a meteo – oceanographic station) is a research platform held by the Italian National Research Centre[26] and its exact location is at 16 km off the coastline of Venice, on 16 m of depth (MERMAID D7.2, 2014)

CNR Acqua Alta - Venice

Source: MERMAID D7.1, 2013

[26] http://www.ismar.cnr.it/infrastructures/piattaforma-acqua-alta?set_language=en&cl=en

The Mediterranean Study site is located in Regione Veneto, which is quite developed, in both economic (26,455 euro GDP per capita) and social level (e.g., 6% unemployment rate.

Employment and economic activities (Thousand people) – data refer to Regione Veneto, 2011

Agriculture, Forestry and Fishing	70.7
Mining	1.4
Manufacturing	620.6
Electricity, Gas and Water Supply	7.1
Construction	184.7
Wholesale & Retail Trade	337.7
Accommodation, Cafes and Restaurants	132.9
Transport and Storage	85.4
Communication Services	47.2
Finance and Insurance	51
Property and Business Services	12
Government Administration and Defence	76.3
Education	109.9
Health and Community Services	143.6
Cultural and Recreational Services	187.7
Personal and Other Services	110.7
ALL INDUSTRIES	2178.9
Not stated or inadequately described	126.7
TOTAL	2305.6

Source: MERMAID Deliverable D 7.1, 2013

In the Veneto Region, there is also the city of Venice which presents special cultural, technical and scientific interest. The city of Venice suffers of the Acqua Alta phenomenon which means that very large tides threaten buildings and monuments of the area. In order to prevent, catastrophic consequences on the city, there is being constructed a flood protection system. The above mentioned Acqua Alta platform, which provides valuable data since March 1970, helps to the design on this flood protection system

As far as the climate of the offshore area is concerned, it is assesses as mild, and therefore it is considered appropriate for safe operations like aquaculture and less suitable for marine renewable energy (MERMAID D 7.1, 2013).

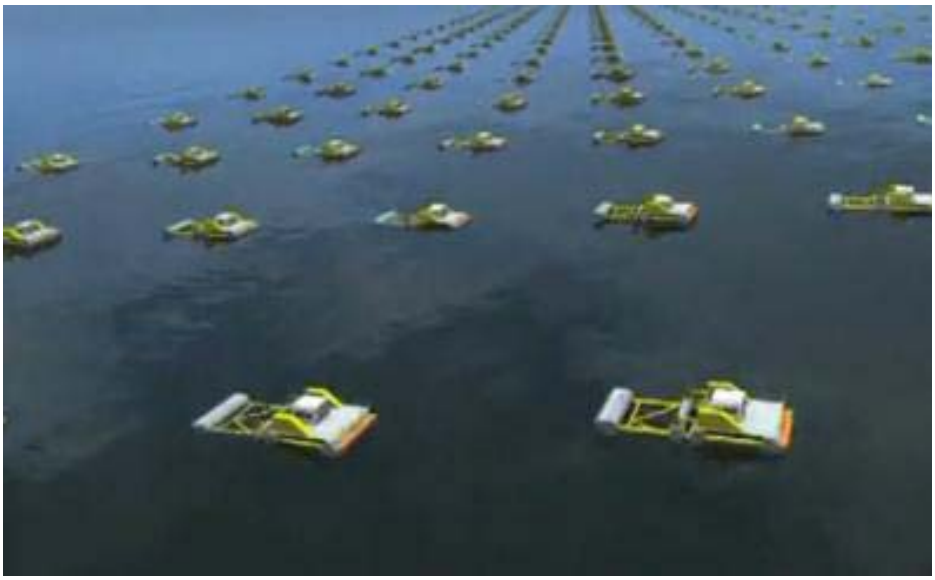
At the Veneto Region there is a lot of aquaculture practice near-shore. However, in the area there is a great amount of high anthropogenic pressure caused by maritime routes and for that reason it is suggested to examine the possibilities of off-shore

installations despite the fact that the sea temperature and physical conditions are not the most suitable that can be found in the Mediterranean.

Moreover, recently there has been some interest in wave energy production. As a result, there have been constructed two pilot installations of point absorbers in Venice lagoon; they are co-funded by the Venice municipality: the GIANT in Giudecca canal (patent 2007, estimated power production: 3-5 kW/module, www.giantgiem.it) and the WEMpower in Certosa island (patent 2011, estimated power production: 35 MW/module, www.wempower.it). The installation of similar devices is also considered for the MUOP at the Mediterranean Site.

To sum up, the main idea for the MUOP at the Mediterranean Site is to combine integrate renewable energy production and aquaculture, since single purpose installations would not be beneficial. Considering marine renewable energy, both waves and micro wind may be included; wave energy converters (WECs) selected would be either floating devices (DEXA) or fixed system on piles (WaveStar) with floaters (MERMAID D7.1, 2013).

A rendering of DEXA wave energy farm

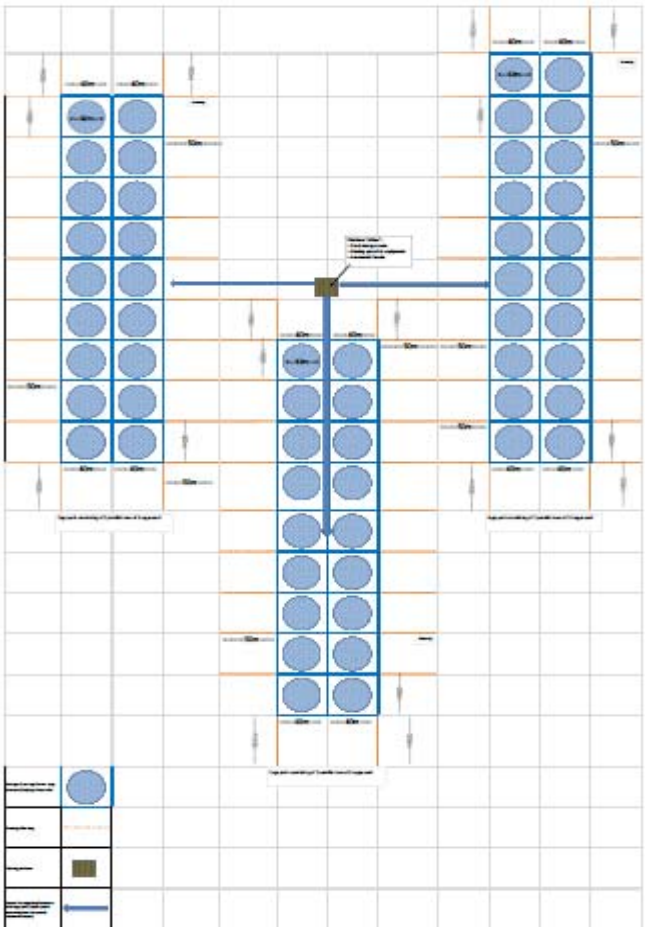


Source: www.dexawave.com

Wave Star prototype (with only two floaters) installed at Hanstholm (DK)

Source: MERMAID D7.1, 2013

Layout proposed for the fish farm



Source: MERMAID D7.1, 2013

III. Assessment tool of the Multi-Use Offshore Platforms

The assessment tool designed for the Multi-Use Offshore Platforms is a framework of factors that should be taken into account during different stages of research and design and it has the capacity to provide a guideline to support decision-making. It was implemented in all four case studies, is a guide for the pathway of the research and provides researchers with all necessary information for the main objectives of the project. This assessment tool has the ability to identify costs and benefits deriving from the MUOP specific design and also to provide important information for the Social Cost Benefit Analysis (SCBA). The assessment tool has four sub-sections; ‘‘it collects systematizes multidisciplinary information for each case study’’ (MERMAID D 7.2,2014):

A) Technical Feasibility Assessment,
B) Environmental Impact Assessment,
C) Financial and Economic Assessment and
D) Social Cost Benefit Analysis.

A) Technical Feasibility Assessment

At the Technical Feasibility Assessment (TFA) section of the assessment tool, the experts are expected to determine if the MUOP design is attainable and in accord with the legal and technical terms. Furthermore, this section includes the estimations of financial costs and revenues of the installation and operation of the platform, in order to a) decide to the project’s time horizon, b) assess any existing possibilities of combined use and c) analyze if there are any options for technological upgrades. Therefore, a number of risks should be pointed out: technical uncertainty, financial uncertainty, impact diffusion, political uncertainty and unclear definition of property rights. It should be mentioned that in case the experts summarize that the MUOP design was not technically feasible then no further assessment was necessary.

The questions posed to experts and stakeholders and the set of risks to be identified:

Technical Feasibility Assessment (TFA) and Significant Risks

A. Technical Feasibility Assessment (TFA)	
a.	Is placement possible? (Take into account legal considerations)
b.	Is placement possible? (Take into account technical considerations)
c.	Approximations to production parameters (Costs: capital, O&M, administration costs and revenues)
d.	Definition of project's time horizon
e.	Possibilities of combined use
f.	Possibility for technological upgrades
Please identify Significant Risks:	
R.A.1	Uncertainty about reliability of the techniques used
R.A.2	Uncertainty about estimates of costs and revenues
R.A.3	Impact diffusion (correlated risks between functions)
R.A.4	Political uncertainty
R.A.5	Unclear definition of property rights
Important: If the suggested MUOP does not pass the threshold for criterion (A) then no further assessment is needed. Please stop here.	

B)Environmental Impact Assessment

Concerning the Environmental Impact Assessment (EIA), MERMAID project researchers shall recognize all the important positive and/or negative environmental impacts (at local, regional and global level) and examine if there is an EIA available for any other similar project(s) in the region. The set risks relate to the uncertainty about climate change and other environmental parameters, the identification of non-linear environmental effects and threshold identification and the classification of the cause of likely irreversible environmental effects of the operation of the platforms.

The questions posed to experts and stakeholders and the set of risks to be identified:

Environmental Impacts Assessment (EIA) and Significant Risks

B. Environmental Impacts Assessment (EIA)	
a.	Significant negative environmental impact (local, regional, global)
b.	Significant positive environmental impact (local, regional, global)
c.	EIA available for similar project in the region
Please identify Significant Risks:	
R.B.1	Uncertainty about Climate Change and other environmental parameters
R.B.2	Non linear environmental effects & threshold identification
R.B.3	Irreversible environmental effects

C)Financial and Economic Assessment

The Financial and Economic Assessment (FEA) section of the tool tries to estimate to the financial costs (capital, operations & management, administrative) of the MUOPs, the potential financial revenues and the efficiency gains from combined use of the platform. At this point any regulatory or institutional restrictions to the installation and operation of the platforms shall be identified. Key points of this section are: a) the feasibility of a sustainable business plan has to be assessed, b) efficiency prices for inputs and outputs of the investment shall be calculated, c) indirect and induced effects shall be outlined, d) to discount investment's cash flows and e) to identify economic efficiency indicators should be identified. The set of risks in this assessment refer to'' the sensitivity to changes of output/input prices and the difficulty in time horizon and interest rate definition''.

The questions posed to experts and stakeholders and the set of risks to be identified.

Financial and Economic Assessment (FEA) and Significant Risks

C. Financial and Economic Assessment (FEA)	
Financial Assessment	
a.	Estimated financial costs: capital, O&M, Administrative
b.	Estimated financial revenues

c.	Efficiency gains from combined use
d.	Regulatory/Institutional Restrictions
e.	Sustainable Business Plan (time horizon plays an important role)
Economic Assessment	
f.	Calculation of efficiency prices for the inputs and outputs of the investment.
g.	Determination of indirect and induced effects (creation of jobs, increased economic activity, increased incomes, etc.)
h.	Discount of the investment's cash flows
i.	Economic efficiency indicators
Please identify Significant Risks:	
R.C.1	Sensitivity to changes of output/input prices
R.C.2	Difficulty in time horizon and interest rate definition

D) Social Cost Benefit Analysis

Last but not least, the Social Cost Benefit analysis (SCBA) section of the tool will try to valuate monetary a) the environmental externalities (using the ecosystem services approach),b) the health and other externalities, c) the local accessibility effects and d) the perceived stakeholders' fairness of distribution of costs and benefits (between income groups, spatial and intergenerational). At this last section, there risks relate with the fact that there might be uncertainty and missing information in estimation of external effects and also in perception formation.

The questions posed to experts and stakeholders and the set of risks to be identified.

Social Cost Benefit Analysis and Significant Risks

D. Social Cost Benefit Analysis	
a.	Monetary evaluation of environmental externalities: provisioning services; regulating services; cultural services, supporting services.
b.	Monetary evaluation of health and other (e.g. educational) externalities
c.	Monetary evaluation of local accessibility effects
d.	Perceived Stakeholders' Fairness of Distribution of Costs and Benefits (between income groups; spatial; intergenerational)

Please identify Significant Risks:	
R.D.1	Uncertainty and missing information in estimation of external effects
R.D.2	Uncertainty and missing information in perception formation

It is evident that each of those assessments should take into consideration not only technical aspects but also the institutional and legislative framework and policies relevant for the selected designs in each region.

IV. Final Designs of the MUOPs at the Mediterranean Site

In order to proceed to the final selection of the MUOP designs for the Mediterranean Study Site, there have been some meetings between the experts and the stakeholders. The selection about the final design 'depends on objective (direct and indirect) factors (environmental issues, social issues, economic issues, financial issues), on subjective preferences (preferences by stakeholders and preferences by experts) related to possible detrimental or beneficial impacts, and on institutional constraints and technical constraints (e.g. unfeasible combination of micro-wind and floating wave)'. Finally, the above mentioned factors have been considered thoroughly and twp final designs were determined. The first option in case that environmental/social impacts are stressed, and the second option if legal conditions are underlined (MERMAID D7.2, 2014).

The first design option suggests: Fixed wave + Micro-wind + Fish farm and is supported by the decision rules:

- Macro-wind is excluded because of environmental/social impacts for stakeholders and experts at 50%, Nonetheless both fixed and floating wave have environmental/social impacts for experts at 50%; floating waves excluded due to the fact that it was not possible, from expert's point of view, at 50%, although no potentials are highlighted by stakeholders.

Technically (Y) and illogically (X) unfeasible multi-use platforms, together with preferences (Z).

	FixWav	FloWav	MicWin	MacWin	FisFar
FixWav		X		Z	
FloWav	X		Y	Z	Z
MicWin		Y			
MacWin	Z	Z			Z
FisFar		Z		Z	

The second design option suggests: Floating wave + Fish farm and is supported by the following decision rules:

- Fixed wave and macro-wind excluded because of legal reasons for stakeholders and experts at 50%, nevertheless also floating wave and fish farm has legal issues for experts at 50%; afterwards, micro-wind is also excluded due to inconsistencies between macro-wind and floating wave. Experts express lack of potentials of floating wave at 50% and no potentials are underlined by stakeholders.

Technically (Y) and illogically (X) unfeasible multi-use platforms, together with preferences (Z).

	FixWav	FloWav	MicWin	MacWin	FisFar
FixWav	X	X	Z	Z	Z
FloWav	X	X	Y	Z	
MicWin	Z	Y	X	X	Z
MacWin	Z	Z	X	X	Z
FisFar	Z		Z	Z	X

The most probable final choice of the MUOP type for the Mediterranean Study Site is the first one: Fixed wave + Micro-wind + Fish farm and the Benefits Transfer Method will be conducted on this design.

C. Ecosystem Services Approach

The human wellbeing and its progress have always depended on the services that the ecosystems provide. The Millennium Ecosystem Assessment Framework (MEAF) (2005), defines ecosystem services as the benefits people obtain from ecosystems'' and divides them into four categories which specifically include provisioning services such as food and water; regulating services such as climate regulation, supporting services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, and other non-material. Ecosystem services also have a significant contribution to economic welfare, first, by contributing to the income and hence to the wellbeing and, second, by preventing severe damages that could impose costs on society and therefore, these two types of benefits should be considered in policy appraisal (Defra, 2007). Consequently, by valuing these ecosystem benefits, policy decision making that include investments in natural capital could make more economic sense. A multi-scale approach, the Ecosystem Services Approach, proposed by Defra (2007) and supported by the MEAF, aims to value ecosystem services and intends to be used as a methodology for the assessment of the interactions between people and ecosystems. The Ecosystem Services Approach follows an impact pathway, which tries to find the connections between ecosystem and the provision of services and the way in which these services affect the human welfare. By using economic valuation techniques, it is possible to translate these benefits into economic value. In the Ecosystem Services Approach, there are some key steps that need to be followed for the valuation of the ecosystem services in a policy appraisal context (Defra 2007, p.22):

1. Establish an environmental baseline.
2. Identify and provide qualitative assessment of the potential impacts of policy options on ecosystem services.
3. Quantify the impacts of policy options on specific ecosystem services.
4. Assess the effects on human welfare.
5. Value the changes in ecosystem services.

By following the key steps indicated above, the Ecosystem Services Approach provides a systematic and manageable way to locate and assess the connections between a policy and its effects on ecosystem services and also estimate the economic

value of these effects, with further goal to obtain/acquire a good environmental status.(Marine Strategy Framework Directive (MSFD) Directive 2008/56/EC).

Moreover, the ecosystem-based approach should also be applied to the EU-Marine Strategies Framework Directive (MSFD) (Directive 2008/56/EC), ensuring that the various human activities will contribute to the accomplishment of good environmental status and that the marine ecosystems are able to welcome these activities and changes. The Multi-Use Offshore Platforms (MUOPs) are part of the EU marine strategy and are likely to have multiple environmental impacts. In order to determine, develop and implement the correct policy, it seems necessary to collect and value the environmental impacts of the MUOPs on the Ecosystem Services and ensure that these impacts stay within the environment-affordable limits. It is expected that the multiple functions of MERMAID's MUOPs (energy production, aquaculture and platform related transport) will have several effects on the Marine Ecosystem Services, directly or indirectly. One the one hand, there are several positive impacts-benefits created by the MUOPs such as the access to local seafood and energy, direct and indirect employment, the production of sustainable food and energy and numerous environmental benefits (e.g. mitigate global warming, improved water quality near coast). On the other hand there are also some negatives MUOPs impacts that should be taken into account such as the potential risk to affect the seabed, the risk to jeopardize fish, mammals and birds etc. Therefore, it is crucial to identify and assess the environmental impacts of the MUOPs and also make a marine ecosystem services approach to identify all ecosystem services obtained from the marine waters and the potential changes on them by the human marine interventions. Consequently, the policy makers can obtain valuable information and results so as to decide whether the Multi-Use Offshore Platform project is suitable for the preservation of a sustainable marine environment and the augmentation of the overall social welfare (Koundouri et al, 2013).

I. Marine Ecosystem Services

As it was already mentioned, ecosystem services are the benefits that people acquire from the ecosystems (directly or indirectly). In the literature, there is an agreement that is necessary to identify and quantify the ecosystem services so as to make a socioeconomic assessment and valuation (Fisher et al., 2009; Turner et al., 2010). As far as the marine sector is concerned, according to the Swedish EPA (Garpe, 2008) and their research on the Baltic Sea, there are 24 marine ecosystem services, of which only 10 function properly, whereas seven of them are severely threatened. In order to classify the marine ecosystem services, there are many ecosystem typologies, but the most widely used is the one that the Millennium Ecosystem Assessment (MEAF, 2005) presented and divides ecosystem services into four categories; provisioning, supporting, regulating and cultural ecosystem services. Based on this classification model, Garpe (2008) and SEPA (2009) identified a number of ecosystem services, provided by the marine ecosystems of the Baltic Sea and the Skagerrak (BalticStern 2013; Luisetti et al. 2011).

List of identified marine ecosystem services

(S=supporting, R=regulating, P=provisioning, C=cultural).

	Ecosystem service	**Brief definition** (after Garpe, 2008)
S1	Biogeochemical cycling	Maintenance of the cyclical movement of energy and materials within ecosystems.
S2	Primary production	The conversion of dead material (inorganic) to living material (organic) by means of photosynthesis.
S3	Food web dynamics	Maintenance of who-eats-who (trophic) relationships among organisms.
S4	Diversity	Maintenance of the variety in genes, species, ecosystems and ecosystem functions.
S5	Habitat	Maintenance of the environments in which organisms live.
S6	Resilience	Maintenance of the extent to which ecosystems can absorb perturbations and continue to regenerate without degrading.

R1	Climate and atmospheric regulation	Maintenance of the chemical composition of the atmosphere and ocean.
R2	Sediment retention	Ecosystems' stabilization and retention of sediments, thus mitigating coastal erosion.
R3	Eutrophication mitigation	Ecosystems' removal of excess nitrogen and phosphorus.
R4	Biological regulation	Organisms' regulation of the abundance of other organisms, e.g. pests and pathogens.
R5	Regulation of hazardous substances	Breaking down, storing and burying of toxic substances and societal waste.
P1	Food	Provision of fish and other food fit for human consumption.
P2	Inedible goods	Provision of marine products not used as food for humans, e.g. fish meal and sand extraction.
P3	Genetic resources	Provision of marine genetic resources of actual or potential value.
P4	Chemical resources	Provision of marine resources for pharmaceutical, chemical and biochemical use.
P5	Ornamental resources	Provision of marine products for the purpose of decoration or handicraft, e.g. amber.
P6	Energy	Acquisition of energy directly from the marine environment.
P7	Space and waterways	Provision of the sea surface as a medium for e.g. transports, site for energy provisions and other constructions.
C1	Enjoyment of recreational activities	Provision of opportunities to have different types of recreation and tourism.
C2	Scenery	Provision of opportunities to enjoy aesthetic values including the appreciation of beauty and silence.
C3	Science and education	Provision of opportunities to have educational activities and research.
C4	Cultural heritage	Provision of opportunities to use the marine and coastal environment for spiritual, sanatory or historical purposes.

C5	Inspiration	Provision of opportunities to inspire art and advertisement.
C6	The legacy of the sea	The appreciation of the marine and coastal environment nature for ethical (non-use) reasons.

Source: Garpe (2008) and SEPA (2009).

However, it has been noticed that MEAF ecosystem services typology can be a bit general when socioeconomic assessment and valuation are needed, since it does not distinguish between ecosystem functions and processes. Therefore, the ecosystem services are often classified into intermediate (or indirect) and final (or direct) ecosystem services (e.g. Boyd and Banzhaf, 2007; Fisher et al., 2009; De Groot, 2006). According to COM (2010), this division can help focusing on both final and intermediate services when listing them and also avoiding double counting when a monetary assessment of ecosystem services in concerned (Söderqvist et al. 2012, Baltic STERN, 2013). The intermediate marine ecosystem services, such as well functioning habitats and the sea's capacity to mitigate eutrophication, play a supporting role to the final services and as a result, they have an indirect influence on human wellbeing. On the other hand, final marine ecosystem services, such as clean water supply, have the ability to directly create a benefit to people, for example water bathing quality and raw materials for energy. Thence, every possible change in the supply of these final services is crucial for monetary valuation. The difference between these two categories is that the final services can be easily identified since they provide direct benefits to humans, while in order to recognize the intermediate services that affect the final services, a more profound understanding of the functions of the marine ecosystems would be needed. Last but not least, it seems necessary to assess correctly both the intermediate and the final ecosystem services in order to perform a correct economic analysis and subsequently a fair policy and decision-making (BalticSTERN, 2013).

II. Identification of the Ecosystem Services of the Mediterranean Site

In general, the Mediterranean Sea provides a lot of benefits to people. These benefits derive from the ecosystem services that the marine environment offers. As it is already mentioned, it is possible to categorize the ecosystem services in four types:

- Provisioning services
- Regulating services
- Supporting services
- Cultural services

The ecosystem services provided by the Mediterranean Site are:

1. Provisioning Services. To begin with, the Mediterranean Sea provides food (fish and mussels), genetic resources and inedible goods. This marine area hosts the major part of aquaculture production of Mediterranean Sea bass (Dicentrarchus labrax) and gilthead Sea bream (Sparus auratus) for many years, since it offers the appropriate conditions to raise these species in the Mediterranean Sea and there is also a long experience in cultivating them. As far as mussel farming is concerned, it is one of the most economically important aspects of global aquaculture .The global production and value of the mussel farming has augmented globally and specifically in the Mediterranean Sea, mussel production is over 700,000 ton y−1 (Fao, 2000). In general, mussel farming causes less impacts than fish farming because of the fact that mussels feed on natural resources (suspended particles) and are not maintained by any additional intensive feeding (Danovaro et al. 2004) . Last but not least, the Mediterranean ecosystem, through its various marine species, holds important marine genetic resources of high value.

By adding to the above mentioned ,it is true that the demand in the global markets for these species increases constantly (either it be for traditional festive dinners in the Med or for sushi-toppings in the American and Asian continents).However, the space in coastal areas is limited ,the number of users high and fish health tends to deteriorate close to the shore. As a result, the idea of moving aquaculture activities offshore and combining it with other activities, such as energy extraction, could originate more cost-effective synergies(MERMAID D7.1, 2013).

2. Cultural Services. The Mediterranean site also offers cultural services to the human beings. Services like swimming or beautiful sightseeing, especially at the place of Venice, are some of the most remarkable services. Also there are a lot of rivers, such as the Po River, which is formed at the mouth of the sea. This river offers plenty opportunities for rest, tourism and vacation. Meanwhile the fish that live and grow in the river are used in traditional restaurants and constitute traditional food plates for tourists and natives. Last but not least, the Mediterranean Sea site is used extensively for recreational activities, like recreational fishing and boating, by the residents and tourists of the Veneto region(MERMAID D7.1, 2013).

3. Supporting Services. It is a fact that the Mediterranean area supports the biodiversity and the resilience, helps maintain the food web dynamics, offers a habitat for the various organisms and is a shelter for the primary production. In particular, the North Adriatic area, on which we concentrate, presents a high diversity of environmental conditions that is translated into a high biodiversity (Ott,1992 ;Coll et al., 2007). The biodiversity of the marine depends on the temperature, the moisture, the sunlight, the waves, and the tide. All these factors help to provide energy which can be useful in many aspects of life. The distribution and abundance of marine fauna and flora of the Adriatic Sea is extensively described in many studies. (e.g. (Riedl 1986; Zupanovic and Jardas 1986). Specifically, the North Adriatic Sea is a key area for marine vertebrate preservation, since it sheltersd important seabird populations (Zotier et al. 1999; Baccetti et al. 2002). Moreover, the Mediterranean area also presents important communities of endangered marine mammals, turtles and elasmobranchs (Delaugerre 1987; Groombridge 1990; Manoukian et al. 2001; Bearzi et al. 2004; Ferretti et al. 2013). Unfortunately, many of these species have been seriously overfished and appear at low densities and still have to cope with significant anthropogenic threats. Regarding marine mammals, nowadays the common bottlenose dolphin (Tursiops truncatus) is a regular species of the northern Adriatic fauna, while the short-beaked common dolphin is very rare (Bearzi et al. 2004).Most importantly, the Adriatic Sea is a feeding and wintering area of great importance for the loggerhead turtle (Caretta caretta). According to the literature ,adult and sub-adult animals go into the north-western Adriatic Sea. Adriatic Sea plays an important role in the biological cycle of Caretta caretta, during the summer and the winter.

Concerning soft-bottom macrofaunal assemblages at shallow sites (<20 m depth), in Adriatic we can find high abundances of Ampelisca spp., Nucula nucleus, Corbula gibba, and less of unidentified Paraonidae, Mysella bidentata, and Lumbrineris spp. Deeper sites (>20 m depth) indicate more balanced species composition. There are characterized by greater average abundances of Sternapsis scutata, unidentified Cirratulidae and Polycirrus cf. haematodes (Abbiati et al unpublished data). Moreover, sites to the north ,which are under the influence of the Po river plume, have a tendency of showing higher average abundances of Abra nitida, Abra albra, Ampelisca spp., Polycirrus cf. haematodes, Polydora flava, unidentified Cirratulidae and unidentified Paraonidae compared to southern sites. In the Veneto region,and especially at the mouths of the river Po and close to river Grado, there can be found some areas called "tegnue" which are concretions of benthic organisms. “Tegnue” was composed by a carbonate cementation of clastic sediments (sands) and by the presence of calcareous skeletons left, after their death, from plants and animals. These plants and animals are called for this reason, 'builders', for example the calcareous algae Peyssonneliaceace and Corallinaceae, cnidarians encrusting, serpulids and bryozoans) (MERMAID D7.1, 2013).

4. Regulating Services. The Mediterranean region offers ecosystem services as the sediment retention, the eutrophication mitigation and biological regulation. In the Northern part of the study region we have the Po river plume, with affects directly the deposition of sediments and the reduced salinity from freshwater discharge (Artioli et al. 2005, Bever et al. 2009). Notably, a high contribution of wave-induced shear stress in shallow water was found inshore of the 20 m isobath, leading to high resuspension of sediments at shallow depths (Bever et al. 2009). The region also demonstrates a decreasing trend of nutrient concentration and production from north to south and from west to east ,due to river runoff and oceanographic conditions, (Zavatarelli et al., 1998). Sediments constitute mainly of mud, with an average fraction of coarser sediments (>63μm) generally lower than 8% dry wt . There are important differences between sites to the north and to the south, as well as between shallow and deep sites. First of all, sites to the north tend to show a higher content in organic matter compared to sites to the south at similar depths. Finally, when having shallow (<20 m) sites, a great proportion of sand can be found while in deep (>20 m) sites, the latter are characterized by a greater content of organic matter, and a lower content of coarse sediment (>63μm) (MERMAID D7.1, 2013).

III. Identification of the Externalities of Multi-Use Offshore Platforms at the Mediterranean Site

Humans, in order to be able to use the services that the marine environment offers, the idea of constructing Multi-Use Offshore Platforms has been created. This aims to amplify the benefits derived from the ecosystem, for example food as well as ecosystem benefits that are more difficult and complicated to obtain e.g. energy. Specifically, wave energy extraction, aquaculture activities and micro-wind extraction are the main functions of the MUOPs at the Mediterranean Site. However, micro-wind installations do not demonstrate any particular environmental impacts. The idea and the construction of these platforms might have positive as well as negative effects-impacts on the environment and the human-being; it is possible to have habitat modifications, impacts stemming from the fish farming as well as from the wave farm.

There is a wide range of the possible impacts:

Externalities on habitats-**Invasive Species.** The construction of fixed MUOPs, involves the replacement of natural, substrata with harder surfaces of stone, concrete, asphalt, metal or other artificial material. These adjustments can change the distribution of a number of species, which bloom at these anthropogenic surfaces. For this reason marine infrastructures are sometimes perceived as an opportunity for habitat enhancement, since it can provide local benefits associated to hard substrata where none previously existed, or potential refuge for rare or threatened native rocky species (Inger et al, 2009 ; Martins et al, 2010; Sheehy and Vik, 2010; Langhamer, 2012; Perkol- Finkel et al. 2012). However, there is evidence that marine infrastructures can offer particularly favorable substrata to many non-indigenous species (NIS) (invasive species). The invasive species may colonize from nearby natural rocky habitats or could spread out of ports, harbors, marinas, or other sources of introduction. This can occur especially when multiple artificial structures are built close to one another.

From a potential aquaculture installation, it is most possible to have an increase in organic matter contents and compositional changes of the sediment below fish cages, an alteration of inorganic and organic chemistry of farm water and sediments, an alteration of abundance, biomass and biodiversity of micro, meio and macro benthic communities and modification of distributional patterns of phyto and microplankton

abundance and production .(Sarà et al 2004, 2011; Pusceddu et al 2007; Aubin et al 2009 ;Luna et al 2013 ; Martinez-Garcia et al 2013).

Additionally, there will be crucial externalities on the **Biodiversity**. Marine infrastructures can affect seriously the genetic and species diversity, the biological resources and the water quality, mainly because of the high levels of disturbance in the marine environment. Specifically, given that the Adriatic Sea is a main breeding location for the loggerhead turtle (Caretta caretta), it is possible that a MUOP installation would seriously disturb the presence and routine of the animal.

Moreover, as far as the aquaculture in concerned, in order to operate it, without harming the environment, people should fit their productivity ability and evaluate the wildlife biomass and the annual discharge of nutrients. In case that the amount of nutrients is not regulated, the amount of phosphorus and nitrogen will be augmented and there might be a serious problem of **eutrophication**. Therefore, the appropriate measures should be taken in order to avoid such a situation. Also maintenance of the technical equipment is needed in order to ensure that the waste would be as little as possible. If measures are not taken, then the flora and the fauna of the area will be affected irreversibly.

Furthermore one of the most relevant issues affecting the environment is represented by the crack of the anti-fouling painting, which is rather toxic but is necessary for the floating parts of the devices. The presence of piles, scour protection at piles, and anchors affects the soft bottom assemblages and increases habitat biodiversity. Nonetheless, it should not change the habitat at the seabed at large scale and it should also not increase the spreading of invasive species.

The wave farm produces a limited local impact a) on hydrodynamics: wake effects are not supposed to produce major changes due to the modest wave absorption (around 70% wave transmission behind the farm); b) on morphology: there is no risk of induced breaking or increased currents, and therefore an increased sediment suspension is essentially expected only during the construction phase. Since the wave farm is placed in deep water, the impact on the coast due to the modest variation of sediment transport patterns induced by wave reduction and change of wave direction will be also very limited. The acoustic impact of the wave farm should be very limited, and therefore it is not predicted to cause disturbance the local fauna. The visual impact is more relevant in case of a fixed installation, for aesthetic and touristic reasons and it is necessary to mention the fact that recreational activities, such as the

recreational fishing, will be restricted since it is not permitted to navigate near the MUOP's area.

In general, the food and water service can be harmed from overfishing, since it affects the quantity and consequently the food web dynamics .Overfishing, besides this service, can also affect prices, employment and profitability. So, imposing fines could prevent illegal overfishing and thus save marine population in the area and of course employment, which is a positive aspect of the MUPs.

On the other hand, the aquaculture will **produce a significant amount of fish,** which can be served as food for the residents of the Veneto region and the tourists as well as for exporting purposes. .Specifically, experts propose the production of **sea bass or sea brea**m, as the most suitable in the Northern Adriatic Sea

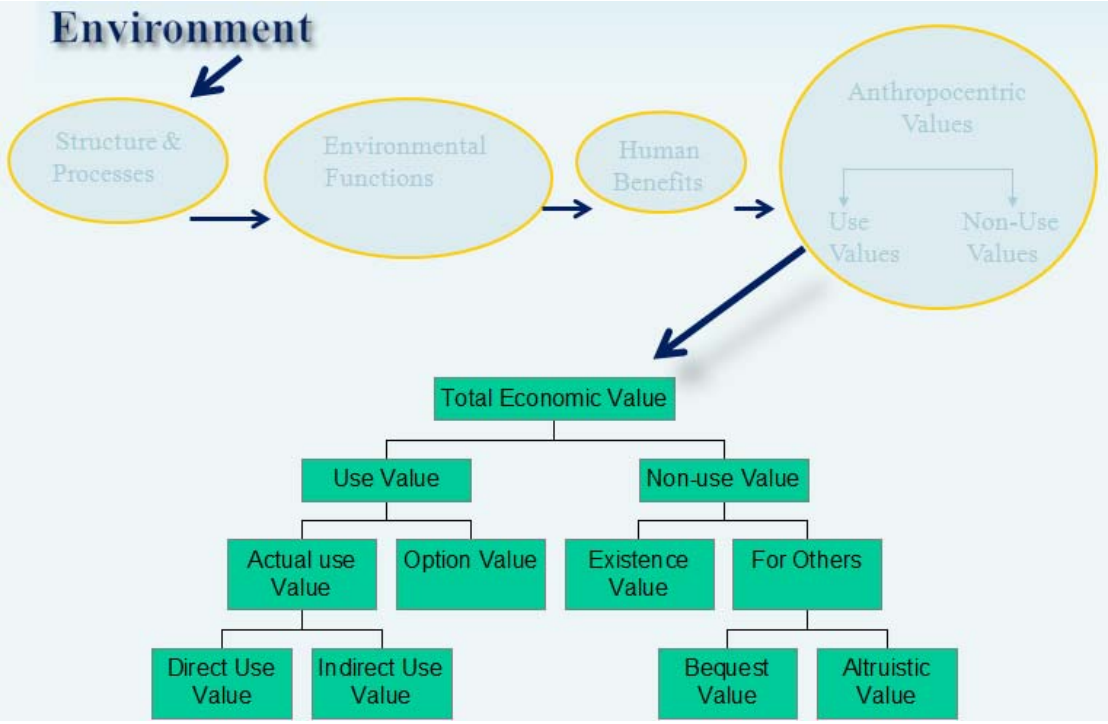
Moreover, offshore structures provide a kind of refuge from trawling activities (De Biasi et al., 2008 ; Terlizzi et al., 2008) given that for safety reasons it is forbidden to navigate closer than a distance of between 200m and 1000m from offshore platforms. Considering that especially in the North Adriatic sea the commercial trawling is intensive, it would be effective to have these effects by the MUP. The problem with trawling is that it modifies the deep benthic systems, causes reduced species "abundances and changes in species composition, with an increase in deposit feeders and a decrease in suspension feeders with increasing fishing pressure'' (Thrush et al., 1998). These effects are particularly apparent in homogeneous sediment types that are usually less affected by natural physical disturbances (Kaiser et al., 1996).

Last but not least, many boat trips will be needed in order to feed and transport the fish, apart from other trips related to multiple uses on a daily basis. Therefore, it would be wise to examine how their frequent routes and their effluents could affect the flora and fauna of the area. All these impacts should be taken into account during the Environmental Impact Assessment and the Social Cost Benefit Analysis.

D. Non-Market Valuation Techniques

The ecosystems provide a vast variety of goods and services upon which human society depends. The value of many of these goods and services is difficult to quantify and measure given that there are no conventional markets on which they can be traded. There are ecosystem services that cannot be marketed like the values that our society places on endangered and threatened species, scenic views, quality of life, and cultural heritage. However, even if they cannot be quantified using conventional methods, it does not mean that their value is zero. There is a way of retrieving the value of these services, using the Total Economic Value (TEV). It is a theoretical approach of describing the benefits derived from the different ecosystem services, the Total Economic Value (TEV) framework. It is a systematic tool for taking into account the total of impacts the marine environment has on human welfare. TEV can be divided into use values and non use values.In order to derive TEV, it is necessary to examine the preferences of individuals for changes in the condition of their environment; regarding the ecosystem services, preferences can be studied either by stated preference methods or by revealed preference methods (Koundouri et al. 2013, Pearce D. et al. 2000).

TEV



During the last decades, there has been a great interest on valuing the ecosystem services and other non-market environmental benefits when it comes to regulatory decisions. Some economists find controversial the idea of incorporating non-market values into decision-making processes, but the majority of them consider it necessary. As a result there are now many peer-reviewed and accepted techniques to quantify the value of non-market goods and services. (ECONorthwest, 2015). These methods try to identify which benefits are worth and how they can be compared to costs in order to assess a policy.

The most commonly used valuation methods of the ecosystem services measure the welfare effects due to changes in quantity or quality of non-marketed goods in order to attain monetary value on changes in ecosystem, recreation, life etc. These methods that can be divided in three categories: the revealed preference, the stated preference and the benefits transfer are:

A. Revealed preference:
    a) the travel cost method,
    b) the hedonic pricing method,
B. Stated preference:
    a) the contingent valuation method and
    b) the choice experiment method.

Benefits Transfer methods

Travel Cost Method (TCM)

The Travel Cost Method uses information on recreation behaviors so as to estimate individuals' values for recreational activities and for the natural resources that support this kind of activities. TCM is broadly applied to valuing site-specific goods related to the provision of a certain environmental resource and especially the recreational value of forests, countryside, or landscapes. TCM is also used in order to provide the direct use value and is not considered appropriate for valuing the bequest or existence value of nature or individual species The basic approach is to extract data on total visitors' amount spent in order to visit a site, including the entrance fee, the travel costs and time dedicated to travel. Then, their demand curve for the service provided by the site is derived. Furthermore, there are two models of the travel costs method:

• **The zonal travel costs model (ZTCM):** that divides the recreational visitors into the zones they originate from and where they currently live. For each zone, the method estimates the corresponding zonal travel costs related to visit of the site and the zonal socio-economic characteristics and afterwards the average visit rate for each zone is calculated. A direct demand recreational curve is derived by regressing the trip generating function (the visit rate on travel costs and other variables). Then, aggregated consumer surplus for each zone is estimated (average consumer surplus recalculated per year and multiplied by the number of inhabitants living in the zone).Finally, total consumer surplus equals the sum of aggregated zonal consumer surpluses. (Markandya et al.,2002; Garrod and Willis,1999; Melichar and Ščasný, 2014).

•**The individual travel costs model (ITCM):** this relates the annual visits made by an individual to the corresponding travel costs. These visits are also defined by other factors such as income, availability of substitute sites, perception of environmental characteristics, other socio-economic characteristics. Then, the individual demand function is constructed and integrated between the actual travel costs and the choke price. Thus, the individual annual consumer surplus is expressed. Multiplying the individual annual consumer surplus by the number of visitors per year, the total annual consumer surplus for the examined site is obtained.

At this point, it should be mentioned that there is another classification of TC methods (Parsons, 2003) that distinguishes a single site model and a random utility model. On one hand, the single site model (SSM) is used to value the recreational function of an entire area. The recreational demand function is constructed as a function where the number of visits is dependent on the travel costs, socio-economic variables, substitute sites, and other observed variables. So as to collect the data, an onsite or off-site sampling strategy is followed. On the other hand, the random utility model (RUM) evaluates the consumer choice of a visitor for a recreational trip and it aims at a benefit related to the change in a site's environmental characteristics and not the value of the site as a whole as in SSM. The dependent variable in RUM is the site. Site utility is a function of travel costs and characteristics of the site. Another difference with the SSM is about the time frame. While for the single site model is a season, the

time frame for the RUM model is a chosen occasion (e.g. one week). (Melichar J. et al. 2004; Pearce et al 2000; Baker et al. 2014).

Hedonic Price Method (HPM)

Hedonic price method treats market goods/services as a group of attributes. In this method, econometric techniques are used in pursuance of decomposing the market prices into "shadow prices" for individual attributes. These attributes may include local environmental quality for residential properties and occupational risks for jobs. HPM is most commonly applied to find variations in housing prices that reflect the value of local environmental attributes. Nevertheless, it can be used to estimate economic benefits or costs associated with environmental quality (including air pollution, water pollution, or noise) and environmental amenities (e.g. aesthetic views). The basic idea of HPM is the separation of the particular effects of specific environmental attributes on the price, in order to derive an implicit or surrogate price of the attribute. It should be underlined that there are two extensively used applications of the HPM. The first application is for the property market; the concept is that the price of a house located in polluted area will be usually lower, if all the other parameters remain constant, than the price of a house located in a better environment. In other words, the price difference can be then expressed as a value of the difference in the environmental quality (Hidano, 2002). The second application takes place in a labor market, where a statistical relationship between the wage rate and all the factors – including the environmental occupational risks that may influence earnings is established, tested, and analyzed. Then the value of a statistical life is estimated (Viscusi, 1993). In order to get the right estimates from HPM application it is necessary that there is a well-functioning and effective market. Summarizing, the hedonic pricing method is relatively straightforward to apply, since it is based on actual market prices and easily measured data; in case that the data are already available, the application of the method would be also inexpensive. The main advantage of HPM is that it can be used to estimate values based on actual choices and that it can be adapted to consider several possible interactions between market goods and environmental quality, which means that this method is quite versatile. On the contrary, if data must be gathered and compiled, the cost of the application of HPM can increase substantially. All in all, the method finds people's willingness to

pay for perceived differences in environmental attributes, and their direct consequences. (Melichar J. et al. 2004; Pearce et al 2002; Baker et al.2014; Pearce et al. 2000).

Contingent Valuation Method (CVM)

The contingent valuation method uses surveys to directly obtain individuals' preferences and willingness to pay (WTP) for non-market goods, such as improvements in the environmental quality. When conducting this method, there is a sample of a population which has to respond to hypothetical situations in the form of a questionnaire. There are three key steps of this method. To start with, basic information about the contingent product should be offered to the people interviewed. Afterwards, the WTP/WTA is retrieved and, in the end, the socio-economic characteristics or respondent attitudes are examined. Finally, in order to obtain the representative value for the entire affected population an average value (mean and median) for WTP/WTA shall be calculated. The survey can be executed in different formats such as open-ended questions, bidding games, payment card data, single-bounded or double-bounded dichotomous choice, referendum methods etc. ; all these formats can be repeated several times, except the payment card and the referendum methods. It is important to mention that the designing and applying of CVM needs a lot of attention in order to get the right results. First of all, the respondents may respond strategically and understate the value or overstate the bids (strategic bidding), give a zero or extremely large bid because they do not accept the contingent situation In addition, the outcome may also be affected by the way that the questionnaire is designed, how the contingent situation, the product and the elicitation format are presented and developed. This could happen due to various reasons; for example when there is the anchoring bias which is a mis-statement of the WTP/WTA, binding the respondent’s value judgment to a known or presumed reference point, e.g. existing taxes or charges. Furthermore, quite important for the integrity of the CVM is the payment vehicle. Payment vehicle represents the way in which the payment will be made, for instance through increased taxes, contributions to special public funds, and reduction in household expenditures. The format of the payment vehicle could influence the respondents’ willingness to pay for a contingent product. Sometimes

CVM can be criticized, because of the fact that people face a fictional situation and make consumer choices without real money. This issue can be overcome by conducting field experiments or laboratory experiments. (Kolstad, 2002; Pearce et al. 2000; Bateman et al. 2002 ; Hanley et al. 2009).

Choice Experiment Method

The term choice modeling (CM) includes a variety of approaches including choice experiments, contingent ranking, contingent rating, and paired comparisons. These approaches are based on the idea that any good can be described in terms of its attributes or characteristics and the levels that these take. For the purposes of choice modeling, one of the attributes will be the cost of providing that good. The Choice modeling methods present respondents with descriptions of one or a number of goods, differing with respect to the levels of attributes and the costs of provision, Respondents are asked to choose between the different goods on offer and the status quo, based on the descriptions of the attribute levels and costs. The various CM techniques differ in the way in which the respondent is asked to make the choice. For example, a contingent ranking exercise would ask respondents to rank the different options in order of preference. Specifically, at the Choice Experiment Method, the respondent is asked to make a choice usually between two alternatives, versus the status quo and estimates are consistent with the welfare economics. First of all, the choice experiment method presents respondents with a baseline scenario corresponding to the status quo and several alternative options in which specified attributes are changed in quantity. Afterwards, focus groups are in charge of deciding which attributes should be included, but the chosen attributes should absolutely include a money value, which represents a payment vehicle. It is considered an advantage of CEM the fact that respondents are more familiar with the choice rather than the payment approach.(Birol et al., 2006a ; Birol et al., 2006b) (Bateman et al. 2000 ; Hanley and Barbier 2009).Last but not least, the choice experiment is considered a highly ‘structured method of data generation’ (Hanley et al., 1998), since it relies on carefully designed “experiments” so as to retrieve the factors that influence choice.

I. Benefits Transfer Method

The benefit transfer method estimates economic values by transferring existing benefit estimates from studies already completed for another location or issue to the study field. In particular, it refers to an "application of values and other information from a 'study' site, where data are collected, to a 'policy' site with little or no data" (Rosenberger and Loomis 2000, p. 1097).

It can also be explored in order to attach a monetary value to environmental damage or whatever benefits. Benefit transfer is not a specific valuation method which would generate a monetary value itself. Benefits transfer is rather a method that estimates economic values for non-market goods and services by transferring available valuation information from original studies already completed to a policy site where monetary values are required. The purpose of the Benefits Transfer is to retrieve form other studies the Willingness to pay for goods such as environmental goods e.g. marine ecosystem services.There are two main approaches to benefit transfer:

i) Unit Value Transfer
   a) Simple unit value transfer
   b) Unit value transfer with adjustment for income differences
ii) Function Transfer
   a) Benefit function transfer
   b) Meta Analysis

When conducting the first approach, the unit value at the study site is simulated to be representative for the policy site; either without (a) Simple unit value transfer or with (b) adjustment for differences in income levels between the two sites (using GDP per capita) and/or differences in the costs of living (using Purchase Power Parity (PPP) indices). In case where Function Transfer Approach is conducted, either a benefit function is estimated at the study site and transferred to the policy site, or a benefit function is estimated from several study sites using meta-analysis (Navrud, 2009).

The Benefits Transfers method is mainly applied when conducting an original valuation study is considered too expensive and/or there are time constraints and lack of resources. It is important to note that the benefit transfer method is most reliable

when the original site and the study site are very similar in terms of factors such as quality, location, and population characteristics; when the environmental change is very similar for the two sites; and when the original valuation study was carefully conducted and used sound valuation techniques.

The simplest type of benefit transfer is Unit Value Transfer, where existing values are used to assess the same value at other sites. These estimates are based on expert judgment in combining and averaging benefit estimates from a number of existing studies. These "Unit Value Transfer" may be adjusted for characteristics of the study site when they are applied.

A more meticulous approach involves transferring a benefit function from another study. The benefit function statistically relates peoples' willingness to pay (WTP) to characteristics of the ecosystem and the people whose values were obtained. An individual's income level has a great impact on his willingness to pay for public goods (Jacobsen and Hanley 2009). When a benefit function is transferred, adjustments can be made for differences in these characteristics, thus allowing for more precision in transferring benefit estimates between contexts.

Different standards for benefit transfer may be applied in different contexts. For example, a higher standard of accuracy may be required when the costs of making a poor decision are higher. A lower standard of accuracy may be acceptable when costs are lower, such as when the information from the benefit transfer is only one of a number of sources of information, or when it is used as a screening tool for the early stages of a policy analysis.

VALUE TRANSFER GUIDELINES

In detail, the application of the benefit transfer method involves several steps. Oriented to the economic valuation of environmental goods, eight steps guidelines are proposed (Navrud 2007, Navrud 2009):

1) Identify the change in the environmental good to be valued at policy site
2) Identify the affected population at the policy site
3) Conduct a literature review to identify relevant primary studies (based on a database)
4) Assessing the relevance and quality of study site values for transfer
5) Select and summarize the data available from the study site(s)

6) Transfer value estimate from study site(s) to policy site
7) Calculating total benefits or costs
8) Assessment of uncertainty and acceptable transfer errors

The first steps involve the identification of the change at the policy site and also the affected population; Desvousges et al. (1998) use the affected population step as the last step in their Value transfer guide. Afterwards, already existing studies or values that are relevant and that can be used for the transfer should be reviewed. There is a variety of valuation databases that can be useful. Second, the existing values should be examined in order to determine whether they are appropriately transferable. In other words, it should be examined whether the service being valued is comparable to the service valued in the existing studies. This also includes determining whether the features and qualities of sites or ecosystems are similar, including the availability of substitutes. In the meantime, it should be verified whether the characteristics of the relevant population are comparable. This means determining whether the demographics, and peoples' preferences, are similar between the area where the existing study was conducted and the area being valued.

At a third stage, the quality of studies to be transferred should be evaluated. It is certain that the better the quality of the initial study, the more accurate and useful the transferred value will be. This step requires the professional judgment of the researcher. Afterwards, the existing values should be accordingly adjusted to better reflect the values for the site under consideration, using all the information that is available and relevant. The researcher may need to collect supplemental data, like survey on key informants, talk to the investigators of the original studies, get the original data sets, check the income levels of the citizens, or collect some primary data at the study site to use to make adjustments. The final steps includes the estimation of the total value by multiplying the transferred values by the number of the people affected, calculating the total costs and assessing of uncertainty and acceptable transfer errors. The transfer error (TE) is calculated as the percent difference between the transferred estimate and the policy site estimate TE = (WTPt-WTPp)/WTPp.

On one hand, among the advantages of the Benefit transfer are considered the low cost and the time efficiency. This method has been proven less expensive and faster than conducting an original valuation study. Also, it can easily and quickly be applied

for making gross estimates of recreational values. The more similar the sites and the recreational experiences, the fewer biases will result. It can be used as a screening technique to determine if a more detailed, original valuation study should be conducted.

On the other hand, the benefit transfer method faces some issues and limitations as it may not be accurate, except for making gross estimates of recreational values, unless the sites are quite alike and share all of the site, location, and user specific characteristics. From a statistical point of view, extrapolation beyond the range of characteristics of the initial study is not recommended. The researcher may have difficulty in tracking down the appropriate relevant studies or assessing the existing ones, especially because unit value estimates can quickly become dated.

Last but not least, Hanley et al. (2013), in an effort to examine whether nonmarket goods values are sensitive to cultural variations, have come to the conclusion that if differences in income levels have been considered during the valuation exercise, then the cultural differences between the sites do not play a significant role at the estimated values.

All the above mentioned methods along with their benefits and limitations:

Table 1 – Choice of Valuation Methods for Different Ecosystem Services

Valuation Method	Element of TEV captured	Ecosystem Service valued	Benefits of approach	Limitations of approach
Travel cost	Direct and indirect use	All ES that contribute to recreational activities	Based on observed behaviour	Generally limited to direct use values and recreational benefits. Difficulties arise when trips are made to multiple destinations.
Contingent valuation	Use and non-use	All ecosystem services	Able to capture use and non-use values	Bias in responses, resource-intensive method, hypothetical nature of the market
Choice experiment	Use and non-use	All ecosystem services	Able to capture use and non-use values	Similar to contingent valuation above
Hedonic pricing	Direct and indirect use	ES that contribute to air quality, visual amenity (e.g. forests), landscape, quiet i.e. attributes that can be appreciated by potential buyers	Based on market data, so relatively robust figures	Very data-intensive and limited mainly to services related to property
Benefit transfer	Direct and indirect use	All ecosystem services, but most accurate for recreational use values	Inexpensive and quick way to economic benefits	Transfer errors are inevitable. High demands on similarity across sites.

Source: based on Defra (2006 & 2007)
Note: ES = Ecosystem Services

E. Benefits transfer-Findings of the literature review

When conducting a benefits transfer method, it is possible to come upon numerous and different studies that estimate, analyze and display the values needed but are conducted in different places. Nevertheless, for this method, it is important to choose the most suitable values estimates from the different study sites in order to adjust and apply them to our policy site. Therefore, it seems necessary to take into account some factors so as to select the right value estimates for the several ecosystem services. For the purpose of this dissertation, an extensive and meticulous review of the existing literature has been carried out in order to locate the appropriate values estimates that can be transferred. The stressors, the location, the population and the baseline scenario of every study site have been taken into consideration before deciding on the most relevant study sites and their values' estimates.

In particular, in this valuation exercise, the research was focused primarily in Italian, Mediterranean and European Territory. Although in Italian territory there were found some appropriate case studies on ecosystem services like food and specifically on the value of fish production, it was not possible to find suitable studies on other marine ecosystem services like eutrophication mitigation. In order to execute the literature review, the EVRI^{TM} - The Environmental Valuation Reference Inventory^{TM} (www.evri.ca), the Econlit and the Google Scholar have been used and provided valuable information to the research.

Since the Multi-Use Offshore Platforms is a rather recent and on-going project in European territory, studies on marine offshore platforms, valuing their externalities, have not been found and as a consequence the literature review was focused on finding and selecting the most appropriate estimates of separate values that could derive from a possible construction of the Multi-Use Offshore Platform in the Mediterranean site .The impacts chosen to be assessed are: Biodiversity, Fish production ,Invasive Species, Recreational Activities and Eutrophication. The three main study criteria were : i) focus on specific ecosystem services and their impacts, ii) the water body being a marine area, iii) studies conducted in Europe and preferred when in Mediterranean. The table presents the valuation studies in European area,

which were assessed and designated as the most relevant, regarding our policy site in the Mediterranean.

Overview of studies considered for the benefit transfer:

AUTHORS	STUDY COUNTRY	YEAR OF DATA	ECOSYSTEM SERVICE-IMPACT	METHOD	WTP VALUES
Sotorrío L. et al. (2008)	Spain	2006	Food: Fish Production: Sea Bream	Statistical analysis of survey data using the Kruskal-Wallis rank statistic test.	5,32 €/Kg per consumer for aquaculture sea bream (Household=2,83p.(OECD) → ~15,06€/Kg/household)
Fernández-Polanco J. et al. (2013)	Spain	2009	Food: Fish Production Sea Bream	Discrete Choice Experiment (DCE)	Marginal Willingness to pay for Sustainable fishery 4.98 €/Kg
Sotorrío L. et al. (2008)	Spain	2006	Food: Fish Production Sea Bass	Statistical analysis of survey data using the Kruskal-Wallis rank statistic test	6.59 €/Kg/ consumer for sea bass by aquaculture
Mauracher C. et al. (2012)	Italy	2011	Food: Fish Production Sea Bass	Choice Experiment (CE)	13 €/kg/consumer for sea bass Fish farmed in the Veneto region (household=2,8 p.> 36,4 €/kg/household)
Söderqvist T. et al. (2000)	Sweden	1998	Eutrophication Mitigation	Contingent Valuation Method (CVM)	436-725 SEK/ adult resident/year in the counties of Stockholm and Uppsala. (conservative-non conservative scenario)

AUTHORS	STUDY COUNTRY	YEAR OF DATA	ECOSYSTEM SERVICE-IMPACT	METHOD	WTP VALUES
Ahtiainen, H. et al. (2012)	Europe - Italy - Ireland - Lithuania - Sweden - Poland - Greece - Bulgaria - Belgium - Denmark - France - Finland	2010	Eutrophication Mitigation	Bayesian techniques	For Reducing Eutrophication: $49.60/household/year for a small change in a large area in the Baltic Sea. $470/household/year for a substantial change in a large area in the Baltic Sea
Diaz P. et al. (2012)	Spain	2009	Biodiversity	Choice Experiment (CE)	17.49€/household/ year (Biodiversity high in the area) 21.22€ /household/year (Biodiversity Medium in the area) (They are willing to pay more for the medium level of biodiversity in order to ensure that it will be preserved)
Martin Lopez B. et al. (2007)	Spain	2004	Biodiversity	Contingent Valuation Method (CVM)	23.2 €/ household/year
Kaval P. et al. (2007)	Greece	2003	Biodiversity Caretta- caretta	Contingent Valuation Method (CVM)	41.83 €/ resident Onetime payment for loggerhead turtle protection. (Household=2,73 persons(OECD)→ ~114,2€/household)
Nunes P. et al. (2004)	Netherlands	2001,but the estimations in 2000	Biological regulation-Invasive Species: Harmful algal bloom species	Contingent valuation Method (CVM)	76 €/person/year for the marine protection program intended to prevent harmful algal bloom species.

AYTHORS	STUDY COUNTRY	YEAR OF DATA	ECOSYSTEM SERVICE-IMPACT	METHOD	WTP VALUES
Stolte W. et al. (2003)	Italy	2003	Biological regulation-Invasive Species: Harmful algal bloom species, Diarrethic Shellfish Poisoning (DSP)	Contingent valuation - dichotomous choice	19 €/person/year Estimates for Reducing Harmful Algal Blooms (Household=2,58 persons(OECD)→ ~49,02€/household/year)
Defrancesco E.et al. (2000)	Italy	1999	Recreational activities: Sports-fishing	Contingent valuation	94.7€/person/year for the recreational use of the Venice Lagoon (Household=2,40p. (Veneto Region,Mermaid)→ 227,28€/household/year)

Valuation studies that examine the same ecosystem services and externalities, in European territory:

Food-Fish production

''Analysis of seabream and seabass consumption in the Mediterranean countries of the European Union.''

By Luna Sotorrío, J.M. Fernández-Polanco and J.L.Fernández Sánchez

In their study, Sottorio et al. 2006 analyze the situation of the sea bream and sea bass market, in order to provide relevant data to design sustainable development strategies. The first part of their work is an aggregated study about the factors affecting consumption in the Mediterranean countries of the European Union, while the second part is a study on the Spanish market and examines the influence that awareness towards aquaculture has on consumption patterns and valuation of the species. The Spanish case has been studied through the statistical analysis of survey data (2006) and the method used for the identification of sea-bass and sea-bream willingness to pay was the Kruskal-Wallis rank statistic test and shows the different prices that

consumers are willing to pay for aquaculture products and for fish from capture fisheries.

''Are retailers' preferences for seafood attributes predictive for consumer wants?Results from a choice experiment for seabream' (Sparus aurata)''

By José Fernández-Polanco , Simone Mueller Loose & Ladislao Luna

On this case study, Fernández-Polanco et al. examine the farmed sea bream (Sparus aurata) and which attributes and claims are able to successfully influence Spanish consumers' perceived value of seafood and to which degree consumers and retailers in a traditional fish market differ in their choice reaction to these attributes. The aim of this study is to assess the importance given by consumers to four main characteristics of sea bass (country of origin, size, production method – organic or conventional – and price) so as to be able to formulate marketing strategies. The fish market section of the Central Food Market (Mercado de la Esperanza) in Santander, the capital of Cantabria, a region at the northern coast of Spain was selected for this choice experiment (CE) is applied in order to define not only the ordinal ranking of preferences but also the willingness to pay (WTP) for the key characteristics of the newly-introduced product. The findings in this study indicate that consumers show a higher WTP for the sea bass country of origin than for the breeding method used.

''Consumer preferences regarding the introduction of new organic products. The case of the Mediterranean sea bass (Dicentrarchus labrax) in Italy''

By C. Mauracher , T. Tempesta , D. Vecchiato

On this paper Muracher C. et al. analyze the preferences of consumers regarding the introduction on the Italian market of a new product: organic Mediterranean sea bass and the importance given by consumers to four main characteristics of sea bass (country of origin, size, production method – organic or conventional – and price) is assessed. A choice experiment (CE) is applied order to define not only the ordinal ranking of preferences but also the willingness to pay (WTP).

Eutrophication Mitigation:

''The regional willingness to pay for a reduced eutrophication in the Stockholm archipelago''

By Tore Söderqvist and Henrik Scharin

In this study, Söderqvist and Henrik Scharin present the results of an effort to quantify the benefits of a reduced eutrophication effects in the Stockholm archipelago, Sweden, which are estimated by an application of the contingent valuation method. The mean willingness to pay per adult resident in the counties of Stockholm and Uppsala people's potential, which is the willingness to sacrifice a part of their income for the sake of such an environmental program, is estimated to SEK 436-725 per year per adult resident in the counties of Stockholm and Uppsala .

''The value of reducing eutrophication in European marine areas — A Bayesian meta-analysis''

By Heini Ahtiainen and Jarno Vanhatalo

In their study, Ahtiainen and Vanhatalo, use a Bayesian meta-analysis in order to summarize available information on the value of the recreation, biodiversity, and fishing benefits of reducing eutrophication in European sea areas, and to provide welfare predictions for different scenarios. The results indicate that the perceived benefits of reducing eutrophication in European marine areas can be considerable, with the predicted annual willingness to pay per person ranging from $6 for small local changes to $235 for substantial changes covering large sea areas. The findings suggest that values differ between marine regions, highlighting the importance of investigating previously unstudied geographical areas.

Biodiversity:

''Valuing Climate Change Mitigation in Coastal Environments Exposed to Extreme Natural Hazards: A choice experiment simulated for different time horizons''

By Pedro Diaz, Phoebe Koundouri, Benedique Rulleau, Kyriaki Remoundou

In this study, the authors concentrate on natural risks caused by climate change. Moreover they calculate the willingness to pay (WTP) to avoid environmental and health risks in coastal environments. The method used is choice experiment and their study site is in Santander, Spain. The challenges that this site has to confront because of the climate change are: (a) vulnerability to marine dynamics, with effects on its beaches (and their role as focal locations for social and touristic activities) as well as built environment and businesses, (b) loss of marine biodiversity and (c) increase in exposure to medusas and other alien species present on the beaches, causing restriction of bathing activities due to health risks.

''The non-economic motives behind the willingness to pay for biodiversity conservation''

By Berta Martín López, Carlos Montes, Javier Benayas

In this study, contingent valuation is used in order to indicate the relationships among human attitudes towards biodiversity, its economic value and the public awareness for biodiversity conservation. The study site is the Doñana National and Natural Park (SW Spain). The authors have found a strong correlation between individuals' attitudes towards particular species and their stated willingness to allocate funds for their conservation.

Social Values of Biodiversity Conservation for the Endangered Loggerhead Turtle and Monk Seal

By Pamela Kaval, Mavra Stithou, Riccardo Scarpa

Kaval et al. in their study focus on the Mediterranean monk seal (*Monachus monachus*) and the loggerhead turtle (*Caretta caretta*) which are two species on the priority list for conservation in Greece. They conducted a survey with the use of the Contingent Valuation Method (CVM) on Zakynthos Island in Greece where there is a marine park for the conservation of such species. The survey is carried out on visitors

and residents of this island who were asked about making donations or paying a tax. Their findings show that that everyone was willing to pay to protect these species, but the residents were willing to pay more than tourists. In their study, they recommend an increase in the airplane landing fee to Zakynthos to contribute towards funds for loggerhead turtle and monk seal protection.

Biological regulation-Invasive Species

Can People Value Protection against Invasive Marine Species? Evidence from a Joint TC–CV Survey in the Netherlands

By Paulo A.L.D. Nunes and Jeroen C.J.M. van den Bergh

This study by Nunes and Van den Bergh uses the Contingent valuation (CV) and the travel cost method (TCM) in order to estimate the non-market benefits that a marine protection program against the harmful algal bloom species (HABs) could have. The study site is located along the North-Holland open sea coastline of the Netherlands. The impacts in this study included recreational advantages determined using TCM and bio-ecological benefits measured using CV. The data were collected by a 2001 survey of a random sample of visitors to the Zandvoort, in the North-Holland coastline.

ECOHARM: The Socio-economic Impact of Harmful Algal Blooms in European Marine Waters"

By Stolte W., S. Scatasta, E. Graneli, H. P. Weikard and E. Van Ierland

In this study Stolte et al. count on several valuation techniques to assess the impact of harmful algal blooms in European marine waters. A contingent valuation survey was administered via face-to-face interviews in the summer of 2003 to randomly selected tourists in Riccione (Italy), Galway (Ireland), Hanko (Finland), and Hyéres, Les Pradet and Corquieranne (France), in order to estimate Annual Individual Willingness to pay (WTP) for Reducing Harmful Algal Blooms in Four European Countries.

Recreational activities-Sports fishing

Recreation Management in Venice Lagoon

By Edi Defrancesco and Paolo Rosato

Defrancesco and Rosato use the Contingent valuation Method in order to estimate the recreational and sport-fishing demand in the Venice lagoon of Italy. So as to make the assessment of the consequences of annual charge for lagoon recreational use by boats, demand methods have been used. The interviews were conducted to a representative sample of boat owners which go on trip to the lagoon. There has been made a preliminary search within the wet docks facing the lagoon and within the moorage holders on the canals in the Venice historic center in order to synthesize the representative group. Their results of the study indicate that in this territory there is an intense recreational activity involving over 13,000 users and 70,000 trips per year.

Cultural values

By the primary environmental assessment there were not located any cultural externalities deriving from the implementation of the Multi-Use Offshore Platform. However, since our platform is near the city of Venice, it would be interesting to present the willingness to pay of the Venice residents in order to protect and preserve the cultural values of the city. For these reason, there have been searched several studies and finally there are two of them that are the most suitable. First, we have a study by Brandolini S. and Disegna M., where a contingent valuation survey is conducted in Venice, in order to estimate visitors' willingness to donate (WTD) to the Venice flood defense program. The authors arrive to the conclusion that regarding the whole sample (data for 2002), and from a conservative point of view, the representative WTD is €2.93 (€3.52, indexed 2010) per year per person. Moreover, Alberini et al.(2004), in their study, use contingent valuation (CV) study so as to estimate the willingness to pay (WTP) for a public program for the preservation of lagoon, beach and infrastructure in the island of S. Erasmo in the Lagoon of Venice, Italy. Their estimations indicate that that people are willing to pay about 65€/ per household for a public program for erosion control and infrastructure improvement on the island of S. Erasmo in the Lagoon of Venice.

I. Valuation Exercise

In order to proceed to the valuation exercise, there has been carried out a thorough evaluation of the existing literature. Afterwards the most appropriate valuation studies, presented in the last section, were examined and the most suitable for every ecosystem service and impact were selected. The factor that played a crucial role in choosing the most suitable study was the estimated value and when possible, the geographical location, in view of the fact that the sites that are close to each other tend to present similar environmental conditions and their populations tend to indicate similar preferences from a socio-economic point of view, at least concerning the Mediterranean counties. In the above studies, two types of WTP were found: willingness to pay to mitigate the negative effects and willingness to pay to obtain the positive effects.

As far as the food and the fish production are concerned, regarding the sea bream, the study of Sotorrío L. et al. (2008) was chosen because the study is conducted in marine waters and specifically in Spain which is in Mediterranean territory .In this study site as well as in our policy site, in the Veneto region, the most traditional and known source of fish supply to the market is the fish from capture fisheries, while the aquaculture method is not so known. It is interesting that in this paper, we have different estimations for fish by capture fisheries and aquaculture, and the WTP for the fish produced by aquaculture will be transferred to our policy site. The study by Fernández-Polanco J. et al. (2013) is not preferred because the estimations are on the marginal-willingness to pay. Considering the sea bass WTP, the study of Mauracher C. et al. (2012) is the most proper for our case since the survey was carried out at Veneto Region, the same region where our MUOP is placed.

About the eutrophication, the selected study is the one of Ahtiainen, H. et al. (2012). This study in conducted for reducing eutrophication in the Baltic Sea but in order to estimate the final WTP, also studies from the Mediterranean(Italy, Greece) were taken into account, which makes this study more appealing for our policy site. Furthermore, it is important that in this study we have different results for different scenarios of eutrophication. These differentiated results can apply and be transferred to our policy site, where w could also have different scenarios of eutrophication. High eutrophication caused by wave farm and aquaculture activities and medium eutrophication caused by aquaculture. The paper by Söderqvist et al.(2000) was not

preferred because it refers to the Stockholm archipelago, which is quite different to our policy site.

Regarding the biodiversity, the study by Diaz P. et al. (2012), is the most relevant. The study site of Santander shows high biodiversity like our policy site. In this study we have different willingness to pay estimations considering the preservation of high biodiversity and medium biodiversity in the area. These different estimates can be transferred in our policy site. High biodiversity estimates can be translated and transferred as the willingness to pay to preserve the biodiversity in case we have only the wave farm installations, while prices for medium biodiversity as the willingness to pay for preserving biodiversity loss caused by the wave and aquaculture activities. The study by Martín López, B. et al. (2007), although it has a lot of features that apply to our case, it was not preferred since it indicates only one level of biodiversity. Especially, for Loggerhead Turtle (caretta-caretta) the WTP that will be transferred is the one in the Kaval p. et al. (2007) and applies to our policy site to a great extent, since the Zakynthos island, Greece, belongs also to the Mediterranean Sea.

Concerning the Invasive Species the survey by Stolte W. et al. (2003), is considered the most suitable for the benefits transfers exercise since it provides data for Italy. Specifically the survey was conducted with selected tourists in Riccione which geographically belongs to the Northern Adriatic and presents a lot of environmental similarities with our policy site. The study by Nunes and Van den Bergh was not selected because of geographical reasons. Last but not least, as far as the recreational fishing is concerned, the study of Defrancesco et al. (2000) is the most appropriate for our policy site, since it refers to recreational fishing and the survey is about the activity at the Venice lagoon of Italy, at the region of the Mediterranean MUOP site.

In this valuation exercise, the Unit Transfer method is applied. In our case the transfer of an adjusted mean WTP is applied in order to account for differences between the two sites in terms of environmental characteristics and/or socioeconomic characteristics (Bergland et al., 2002). First of all, in some of the studies, the values estimates that are about to be transferred are calculated in different currency than the italian (Euro).Therefore, the values will be converted to local (Italian) currency in the year of data collection. Afterwards, the unit transfer with income adjustment will be applied. According to Navrud and Ready (2007), the adjusted WTP estimate Bp' at

the policy site will be calculated using the following equation: WTPBp' = WTPs $(Yp/Ys)^{\beta}$ where *WTPs* is the original WTP estimate from the study site, *Ys* and *Yp* are the income levels at the study and policy site, and β is the income elasticity of demand for the environmental good in question. Income elasticity of WTP β for different environmental goods is typically smaller than 1 and between 0.38 and 0.69 (depending on the specification of the model) for the EU-15 and the new countries; there have been found significant variations of the elasticity between different countries, with the Central and Eastern European Countries with the lowest income level having the highest income elasticity of WTP (B. Desaigues et al., 2010; Navrud, 2006). For this valuation exercise, the income elasticity of WTP used is 0,5 and the Gross Domestic Product (GDP) per capita figures have been used as proxies for income. Last but not least, the local GDP deflator has been used in order to update the adjusted WTP from the time of data collection to current-currency values (Koundouri et al., 2014) .

The base year used in this study is 2005. Concisely, the key-steps followed for this valuation exercise in order to perform the Unit Value transfers with adjustment for income differences, are:

i)Convert to current currency, at the year of data collection.

ii)Calculate the WTP adjusted at the year of data collection.

iii)Use of the local GDP deflators, setting 2005 as the base year.

The next table presents the transferred Ecosystem Values, after applying the income adjust method.

WTP values(per household/year)

Author	WTP values from the study sites	Transferred WTP values with income adjustments
Sotorrío L. et al. (2008)	15,06€/Kg/household for aquaculture sea bream	**16,82** €/Kg/household
Mauracher C. et al. (2012)	36,4 €/kg/household for sea bass farmed in the Veneto region	**45,122** €/kg/household
Ahtiainen H. et al. (2012)	For Reducing Eutrophication: $49,60/household/year for a small change in a large area in the Baltic Sea. $470/household/year for a substantial change in a large area in the Baltic Sea	**45,7**€/household/year for reducing eutrophication caused by wave farm **433,275**€/household/year for reducing eutrophication caused by wave farm+ fish aquaculture
Diaz P. et al. (2012)	17.49€/household/ year (Biodiversity high in the area) 21.22€ /household/year (Biodiversity Medium in the area) (They are willing to pay more for the medium level of biodiversity in order to ensure that it will be preserved)	**22,19**€/household/ year to protect the biodiversity around aquaculture **26,92**€/household/ year to protect the biodiversity around wave farms
Kaval P. et al. (2007)	114,2€/household Onetime payment for loggerhead turtle protection.	**135,37** €/household Onetime payment for loggerhead turtle protection
Stolte W. et al. (2003)	49,02€/household/year for Reducing Harmful Algal Blooms	**51,33**€/household/year for Reducing Harmful Algal Blooms
Defrancesco E.et al. (2000)	227,28€/household/year for the recreational use of the Venice Lagoon	**265,9**€/household/year for the recreational use of the Venice Lagoon

Exchange rates, GDP per capita based on purchasing power parity (PPP) figures and GDP deflator for Italy (base year 2005=100) were obtained from the World Bank, International Comparison Program database, OECD.STAT and IMF
Figures are expressed in 2005 **€**

Conclusions

In conclusion, we have executed a valuation exercise, using the method of Benefits transfer (Unit Value Transfer Method) in order to assess the impacts associated with the potential implementation of the Mermaid Project and specifically of the construction of a multi-use offshore platform at the Mediterranean site. The baseline scenario in this exercise is that there is not an already existing platform.

The location of the study site is important when conducting the Benefits Transfers method especially for environmental goods and therefore, only studies undertaken in the European territory were used and the ones placed in the Mediterranean were preferred. The policy site, for the potential MUOP, is located in the Northern Adriatic Sea, East of Italy. The area of the considered region covers 18.378 Sq Km, the population is 4.937.854 residents and the number of households is 2.048.902. The obtained value to have sea-bream production by aquaculture is **16,82** €/Kg/household, while the value to have sea bass farmed in the Veneto region is **45,122** €/kg/household. Aggregating this values, it could be proposed that the total value of fish production would be **61,942**€/kg/household. The total value transfer estimate of eutrophication mitigation is **433,275**€/household/year when eutrophication is caused by wave farm and aquaculture activities and **45,7**€/household/year to mitigate eutrophication caused by caused by aquaculture. As far as the biodiversity is concerned, the total transfer value would be **49,11**€/household/year and **135,37** €/household onetime payment for the protection of loggerhead turtle. Furthermore, the value transfer to reduce Harmful Algal Blooms would be **51,33**€/household/year and last but not least the value transfer estimate for recreational fishing would be **265,9**€/household/year. To sum up, although there are no current experiences in fish or wave farms in this specific Mediterranean site, the Mermaid project seems to be also interesting from a socio-economic point of view. The main goals of this project are the efficient use of space, the reduction of negative impacts on the ecosystem and combining energy production and nature values, as the Blue Growth Strategy implies. Regarding the Mediterranean Site, it would be challenging yet promising to integrate private and public institutions and also to comply with the existing legal framework in order to use marine resources in a conscious and responsible way and to aim at a sustainable marine environment.

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