MERMAID

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1 Public Summary

Marine Spatial Planning (MSP) is considered to be a key tool to balance sector interests and achieve sustainable use of marine resources in line with the EU Sustainable Development Strategy. MSP is a public process of analyzing and allocating the temporal and spatial distribution of human activities in marine areas to achieve ecological, economic and social objectives that are usually specified trough a political process.

The MSP principles are designed for governmental policy-makers but in the maritime domain, much development and planning takes place in networks of governments, private actors and science. This challenges the backbone of MSP: can the principles also be used in these networks? In this article we look whether key principles of Marine Spatial Planning can be applied to a participatory design process such as performed in Mermaid, which involves a network of actors as well.

The EU-funded FP7 Mermaid project, focusing on the design of Multi-purpose off-shore platforms at sea was used as case-study. There were four sites where researchers and representatives of aquaculture and wind energy sectors developed different designs of multi-use platforms: the Baltic Sea, the North Sea, the Atlantic Sea and the Mediterranean Sea. The designs were produced by a participatory process that involved a network of actors of science and industry, aiming to integrate different maritime interests, such as shipping and maritime transport, offshore energy, ports development, fisheries and aquaculture and environmental concerns .

It is concluded that the ten key principles can very well be applied to participatory networks that involve a wide range of stakeholders. Although the Mermaid project was not a policy process, the knowledge management and participatory processes entailed many elements of MSP as stakeholders from science and industries were involved in the integral design. It is recommended to involve stakeholders from national and regional governments more explicit in future research and development projects to enhance the integration of all ten MSP principles in these projects more effectively.

2 Introduction

MSP is a tool for integral and sustainable spatial planning of marine space. In this project we use the MSP definition by Maes (2008): “MSP is a public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic and social objectives that are usually specified through a political process”. MSP is one of the key tools mentioned in the European Bluebook for integrated maritime policy (EC, 2007) and is used for different regional planning processes across Europe.

MSP has potential for government planning; it can guide sustainable development of maritime space. The problem is that the execution of different activities occur outside the government sphere of influence. For instance, private and research initiatives play an important role in development of new activities at sea. If MSP principles are not used by private and research initiatives, the full potential of MSP is not used.

This article aims to assess whether these principles of Marine Spatial Planning (MSP) can be applied in participatory design processes, such as undertaken in the EU FP7 project MERMAID.

The research question in this article is as follows: *How can the MSP principles be used to guide participatory design process for multi-use platforms at sea?*

The EU FP7 project MERMAID aims to plan, design and operate multi-purpose off-shore platforms. The project looks to these platforms in an integrated manner. Not only the technical design and operation is addressed but also governance issues like stakeholder participation and an economic approach based on a cost-benefit analysis are taken into account. It is one of the European research project concerned with multi-use platforms, next to H2OCEAN and TROPOS (part of same call) and MARIBE (H2020 call). The EU is expected to continue research support for multi-use platforms in the coming H2020 calls and beyond.

The structure of the present paper is as follows. First, the analytical framework and the methodology is presented. Then, Mermaid project and the four test cases are introduced. The selected four cases will be analyzed focusing on the ten key principles already introduced. For every principle examples of the different sites will be used. We do not explain every principle for every site, but clarify the most crucial examples for every principle. The paper ends with conclusions and recommendations for future projects dealing with maritime activities.

3 Analytical framework

Maritime Spatial Planning (MSP) is worldwide advocated as a promising tool for implementing ecosystem based maritime spatial management, which should resolve inter-sectoral and cross-border conflicts over maritime space (Ehler, 2008; Halpern et al., 2008; Douvere, 2010). MSP is a public, hence participatory, interactive process. Key to success for any interactive process is transparency about roles and responsibilities given to or expected from the involved stakeholders (Röckmann et al. 2015).

Foley et al. (2010) defined ecosystem based MSP as an integrated planning framework that informs the spatial distribution of activities in and on the ocean in order to support current and future uses of ocean ecosystems and maintain the delivery of valuable ecosystem services for future generations in a way that meets ecological, economic and social objectives. In Europe, most ecosystem based sea use management and MSP initiatives are driven by international and European legislation such as the European Commission's Green Paper on Maritime Policy (Douvere and Ehler, 2008).

Further, the EU Communication on MSP (EC, 2008) considers MSP as a key instrument for the application of the European Integrated Maritime Policy and lays out guiding principles encouraging the development of a common approach among member states.

Marine Spatial Planning, in particular its focus on participatory approaches and knowledge management processes, is related to the emergence of diverse forms of governance. Governance concerns 'all processes of governing, whether undertaken by a government, market or network, whether over a family, tribe, formal or informal organisation or territory and whether through laws, norms, power or language.' (Bevir, 2013). Modes of governance refers to the underlying logic which can be recognized in governance processes and which can have a conflicting or synergetic relation with how other actors engage in governance. The modes of governance do not prescribe which stakeholder takes the lead, but how social or physical change (the multiple use of the marine environment) is achieved.

In general we can distinguish between five modes of governance: hierarchy, network, market, self and knowledge. The literature on modes of governance in public administration started with the discovery that new forms of governance emerged in addition to the classical hierarchical notion of governance belonging to the nation state which uses authority, a clear division of tasks, rules, rationality and objectivity to intervene in society and markets (Stoker, 1998). Regulations, spatial planning and national policy plans all belong to this hierarchic governance mode. Scholars as Kooiman (2003) noted that new forms of governance emerged in which government was not solely responsible for the provision of collective goods any more. Often a distinction is made in 'market governance' and 'network governance', and sometimes in 'self governance' and 'knowledge governance' (Michailova and Foss, 2009). In market governance societal change is realized by the powers of the market, where competition and pricing decide what path is selected and where financial incentives are an important instrument. Network governance makes use of the potentials of actor networks, and their ability to combine multiple agenda's and responsibilities and to distribute gains in order to arrive policy outcomes. Reciprocity, collaboration, interdependency, trust and empathy are coordinative principles in network governance (Koppenjan and Klijn, 2004)

Self-governance relies on 'the capacity of societal entities to govern themselves autonomously' (Kooiman 2003: 79). Self-governance is based on a shared identity and a common interest, for instance in the usage of natural resources by local communities (Ostrom, 1999) Knowledge governance involves a transdisciplinary approach to knowledge, a reliance on social learning, a reflexive attitude, is set up by self-organization and boundary arrangements to communicate the results to outside stakeholders (Gerritsen et al. 2013). A design or a vision for the multiple use of the marine environment could be the result of knowledge governance.

Marine Spatial Planning seems to be rooted in hierarchic governance, with a focus on objectives which are measurable and objective and transparency in roles and responsibilities. MSP also involves knowledge governance, because it relies on designing, visioning and knowledge exchange. Because of its participatory objective one can also recognize some network governance in MSP. Self-governance and market governance seem to be lacking modes of governance in MSP.

Until now, the principles of MSP have settled down as guiding principles in planning of maritime space and often governmental policy-makers are considered to be the main users of these principles. However, Marine Spatial planning scholars recognizs that much maritime planning takes place outside the governmental domain; it takes place within networks of public actors, private companies and researchers.

3.1 The ten key principles

The evaluation from the perspective of Marine Spatial Planning is done by an insider scope, through participants from the project and a review of the 10 principles for each of the sites. This review is based on the reports of the interactive sessions (Rasenberg, 2014, Rasenberg, 2013, Rockmann, 2015, van den Burg, 2015).

The following 10 principles for a Marine Spatial Planning process (MSP) are identified by EC (2008):

i. *Using MSP according to area and type of activity:* This principle stresses that it is important to operate within four dimensions, addressing activities (a) on the sea bed, (b) in the water column, (c) on the surface, and (d) the time dimension (EC, 2008)
ii. *Defining objectives to guide MSP*: A strategic plan for the overall management of a given sea area should include detailed objectives. These objectives should allow arbitration in the case of conflicting sectorial interests. (EC, 2008)
iii. *Developing MSP in a transparent manner*: Transparency is needed for all documents and procedures related to MSP. Its different steps need to be easily understandable to the general public. This will allow full information to all parties concerned and therefor improve predictability and increase acceptance (EC, 2008)
iv. *Stakeholder participation*: in order to achieve broad acceptance, ownership and support for implementation, it is equally important to involve all stakeholders at the earliest possible stage in the planning process. Stakeholder participation is also a source of knowledge that can significantly raise the quality of MSP (EC, 2008)
v. *Coordination with Member States, simplifying decision processes:* MSP simplifies decision making and speeds up licensing and permit procedures, for the benefit of maritime users and maritime investment alike. Coordinated and cross-cutting plans need a single of streamlined application process and cumulative effects should be taken into account (EC, 2008)
vi. *Ensuring the legal effect of national MSP:* MSP should be legally binding if it is to be effective. Also, there should be an appropriate administrative framework in place.
vii. *Cross-border cooperation and consultation:* cooperation across borders is necessary to ensure coherence (the OECD argues that coherence is about the overall state of mutual consistency among different policies (OECD, 1996) of plans across ecosystems.
viii. *Incorporating monitoring and evaluation in the planning process*
ix. *Achieving coherence between terrestrial and maritime spatial planning – relation with ICZM*
x. *A strong data and knowledge base:* MSP has to be based on sound information and scientific knowledge. Planning needs to evolve with knowledge (adaptive management). Agree what knowledge base to use. Quality assurance on data and knowledge (EC, 2008).

4 Methodology

This paper is based on an assessment of the ten key principles during the Mermaid project. The authors that were all part of the Mermaid project evaluated the participatory design process undertaken in the MERMAID project with these ten key principles in mind. We explain in this paragraph the objectives of Mermaid and the participatory design process that took place in all four sites.

4.1 Objectives of MERMAID

MERMAID ("Innovative Multi-purpose off-shore platforms: planning, design and operation") developed concepts for the next generation of offshore platforms which can be used for multiple purposes, including energy extraction, aquaculture and platform related transport. It was one of three EU-FP7 funded projects selected for funding in response to Ocean of Tomorrow 2011 on multi-use offshore platforms (FP7-OCEAN.2011-1 “Multi-use offshore platforms") and was carried out during the period 2012 – 2015. The other two related projects are Tropos (“Modular Multi-use Deep Water Offshore Platform Harnessing and Servicing Mediterranean, Subtropical and Tropical Marine and Maritime Resources") and H2Ocean (“Development of a wind-wave power open-sea platform equipped for hydrogen generation with support for multiple users of energy”).

The MERMAID project focussed on four specific sites in European waters with different characteristics and different foreseen uses (see also Figure 1):

- Baltic Sea – Kriegers Flak, an estuarine site, with a focus on offshore wind and fish aquaculture.
- North Sea – Gemini location 85 km north of the Dutch coast, an active morphology site, with a focus on offshore wind and mussel and seaweed aquaculture.
- Atlantic – Cantabrian Offshore Site, a deep water site, with a focus on wave energy and offshore wind.
- Mediterranean – Adriatic Sea off Venice, a sheltered site, with a focus on fish aquaculture and offshore wind.

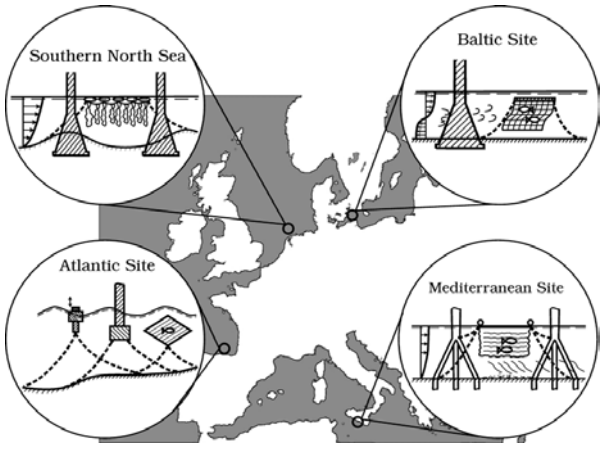

Figure 1: The four sites in the MERMAID project.

MERMAID will develop concepts for the next generation of offshore platforms which can be used for multiple purposes, including energy extraction, aquaculture and platform related transport. The project does not envisage building new platforms, but will theoretically examine new concepts, such as combining structures and building new structures on representative sites under different conditions.

The MERMAID project aims to address the following key-questions:

1. What are the best practices to develop a project on multi-use platforms?
2. What are the accumulated effects of large scale structures on the marine environment?
3. What are the best strategies for installation, maintenance and operation of a multi-purpose offshore platform?
4. What is the economical and environmental feasibility of multi-use platforms?

It is essential that all work under the MERMAID project contributes directly towards real design concepts and industrial applications. For this reason test sites will be studied to develop innovative plans and designs for harvesting ocean energy, aquaculture and logistic support.

The 28 partner institutes forming MERMAID are Universities (11), Research institutes (8), Industries (5) and Small and Medium Enterprises (4 SME's), from many regions in EU. The group represents a broad range of expertise in hydraulics, wind engineering, aquaculture, renewable energy, marine environment, project management as well as socio-economics.

MERMAID 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"). This project shall run from 2012 till 2016 and have a cost of 7,4 million euro. The European Union has granted a financial contribution of 5,5 million euro.

4.2 Case study description

Four case studies were chosen during the first phase of the MERMAID project and are:
The Baltic Sea - a estuarine area with fresh water from rivers and salt water.
The transboundary area of the North Sea & Wadden Sea - a active morphology site
The Atlantic Ocean - a exposed deep water site
The Mediterranean Sea - a sheltered deep water site.

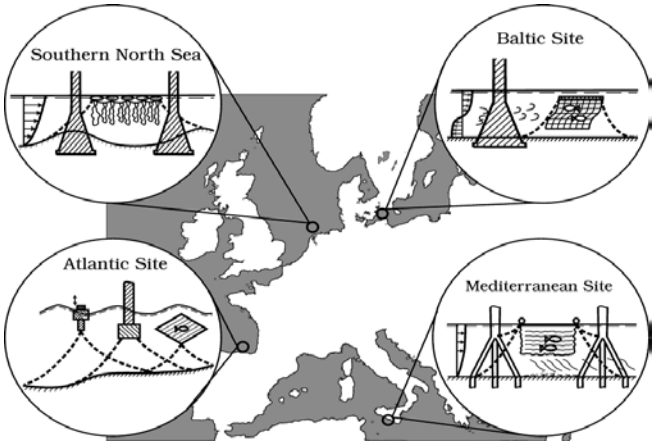

Figure 1. the four sites of Mermaid

The MERMAID project focused on these four regional seas as they represent regional European waters where multiple sectors including transport, fisheries, renewable energy, tourists, commerce and local stakeholders meet each other. Thus, novel innovative design approaches should address many different physical conditions in order to make the best use of the ocean space. Going from deep (North of Spain, Atlantic Sea) to shallow waters with high morphological activity (the North

and Wadden Sea) and further to inner waters like the inner Danish/Baltic areas and the Adriatic sea the focus varies from physical aspects to environmental impacts on a very delicate marine environment. This will allow developing, testing and integrating different technologies through innovative coupling of various activities and services.

At each site, the integration of different uses has been proposed following two different approaches:

a. Integrate different uses in the same space but in different structures – sharing space
b. Integrate different uses in the same structure or platform – sharing structure

Figure 1 gives an overview of the participatory design process which was applied in these four case studies in the MERMAID project. The design process of MUPs in the four cases was organized in three steps:

1. Prepare the designs by identifying the views and needs of all stakeholders with interviews
2. Designing the MUP by organising a round table session involving all stakeholders
3. Evaluate the design by organising a round table session with all stakeholders

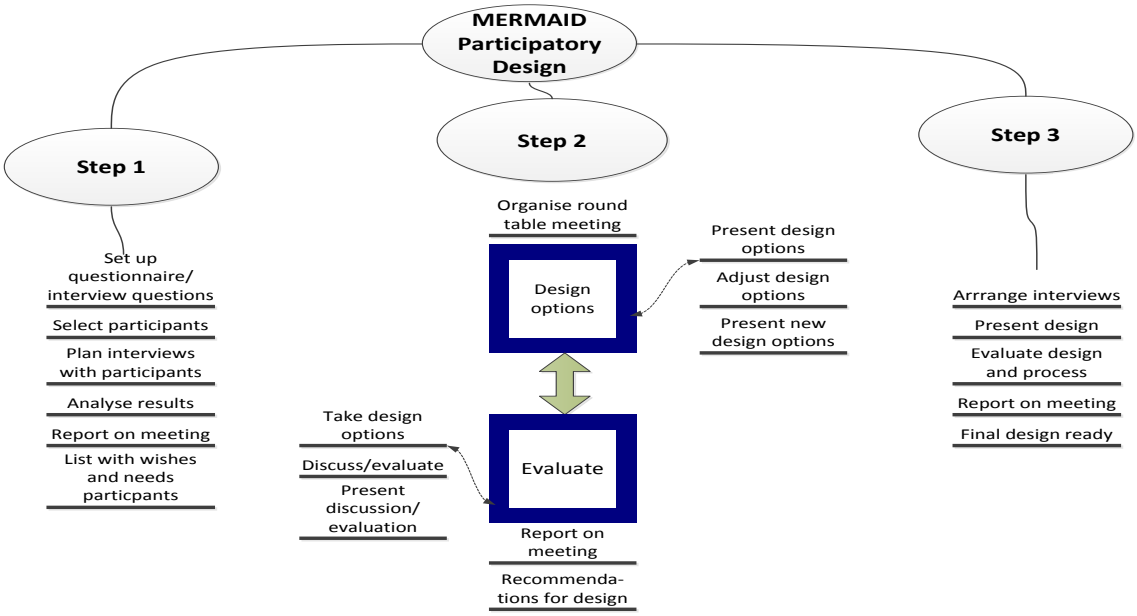

Figure 2. Overview of the MERMAID participatory design process

The work performed in the participatory process was not to make the final design, but to organise the input of the stakeholders that can be used to make the final design. The final design is the responsibility of the site managers for the different case studies of the MERMAID project. The site managers also played a crucial role in organizing the three steps of the participatory design.

Step 1 took place in 2012 and the results of step 1 are reported in Rasenberg et al. (2013). In step 1, interviews were held with representatives of a wide range of stakeholders. Step 1 focused on identifying different views on ecological, economic and social objectives of MUPs, challenges and technical, social-economic and ecological constraints faced. Equipped with a resulting wish list

from this step, designers started working on developing the first MUP design options. These design options were discussed later in step 2, an interactive round table session involving all relevant stakeholders.

After step 1, the designers of each of the case studies made one or more design options based on technical feasibility and the earlier wishes expressed by the stakeholders. These options for design(s) were discussed with the stakeholders in step 2 of the participatory approach: the site specific round table meetings. These round tables represent an iterative cycle where draft design options were presented, stakeholders were asked for their feedback and further input, and designs were further developed. Involving stakeholders in the design process aimed at reaching agreement on the most feasible design in each of the case studies, taking into account the technical, economic, ecological, spatial and social possibilities in a complex, interactive process.

Step 3 was originally meant to be a round table session where the final design concept is evaluated with the participating stakeholders. During a MERMAID project workshop in September 2014, the MERMAID project team unanimously decided to modify the original approach, because all site managers reported “stakeholder fatigue”, indicating that no stakeholder would be willing to participate in a final MERMAID-evaluation workshop. The main reason for this fatigue is that there are still too many obstacles (regulatory, institutional, financial, social and economic) when it comes to implementing MUPs in real life.. Instead of organizing a final round table with stakeholders to evaluate the final design, it was agreed to carry out the stakeholder evaluation of the final designs through individual email interviews.

A group of representatives of all major types of stakeholders were invited for the three steps. Five stakeholder categories were identified:

1. Governing bodies/policy makers such as regional, national and European officers
2. End users of the MUP, e.g. energy companies and aquaculture entrepreneurs
3. Suppliers of the MUP such as cable companies and construction businesses
4. Representatives of other offshore activities such as fisheries, shipping, and mining sectors
5. Discourse community, including e.g. (environmental) NGO’s, local citizens, universities and research institutes

A set of alternatives have been proposed and presented to the stakeholders in the different meetings in order to evaluate the level of acceptance of each other.

Figures 3 and 4 show a sharing space concept and a sharing structure concept proposed in the Atlantic site.

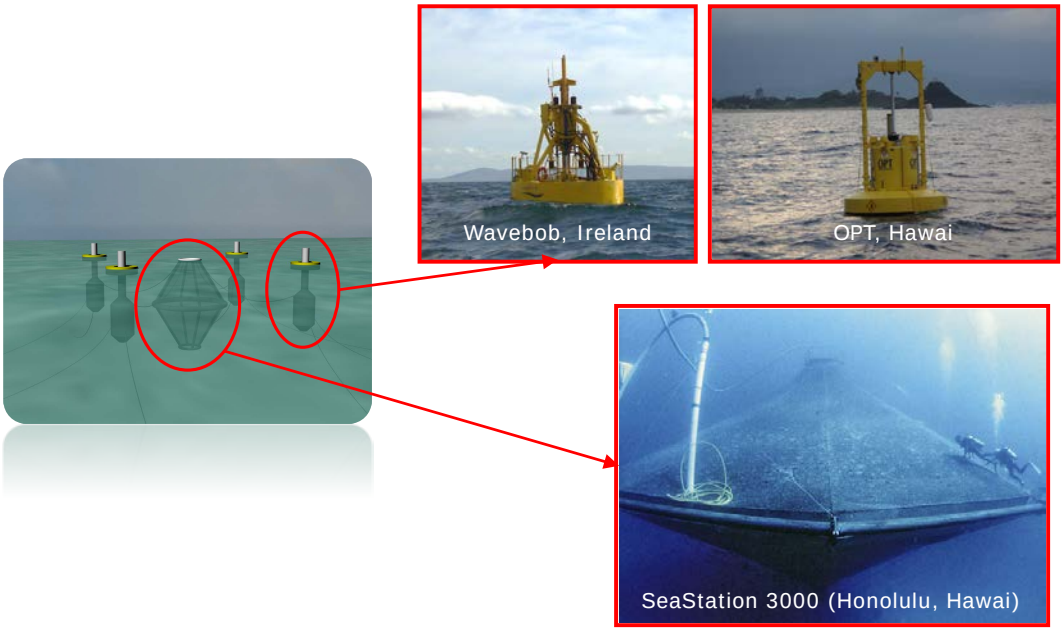

Figure 3. Sharing space concept proposed in the Atlantic Site

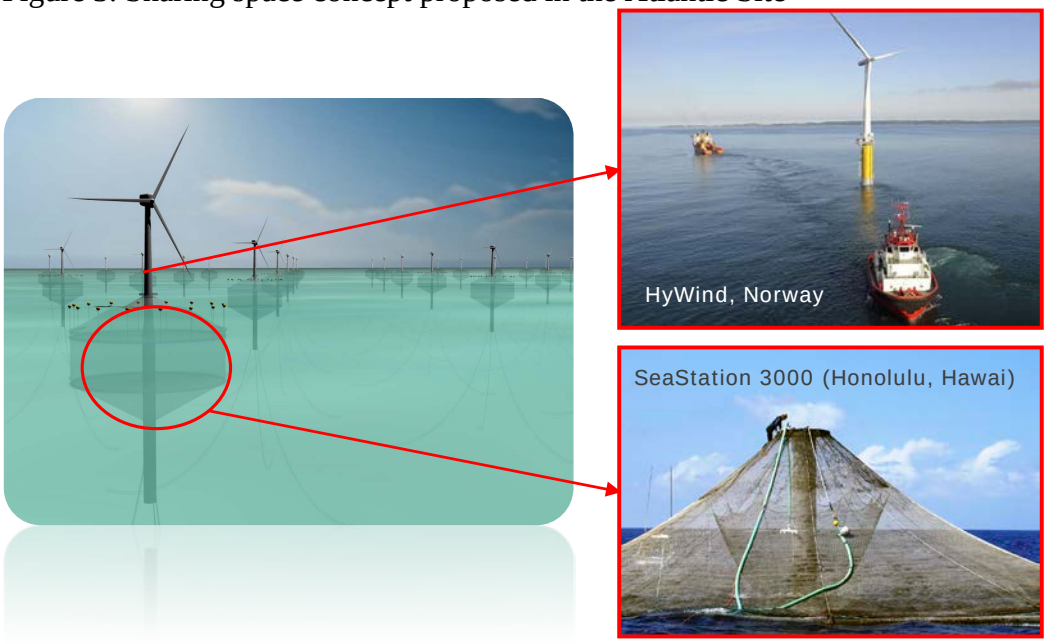

Figure 4. Sharing structure concept proposed in the Atlantic Site

Table 1 presents a brief summary of the natural conditions, aspects of stakeholder participation, the final design and specific issues, as these had been described during the project in each MERMAID site.

Table 1. Environmental Characteristics, Design Types and Specific Issues in each MERMAID Site

Site, Sea	Conditions	Participation	Design	Specific issues
Kriegers flak, Estuarine site, Baltic	• Cold brackish waters with optimum salinities	• limited number of actors	• gravity based turbine foundations	• Dredging impact • Mariculture spills

sea	for temperate fish • Location on the pathway for exchange flow between Baltic proper and the North Sea • high wind energy potential • water depth?	• real life interest in cooperation • participants with interest in offshore wind and aquaculture	• extensive fish aquaculture	
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 • water depth ??	• variety of actors • No consensus on need for MUPS	• gravity based turbine foundations • extensive seaweed and mussel aquaculture	• Economic feasibility • Scour and backfilling processes • Environmental impact
Cantabrian Offshore Site. Far Offshore area, Atlantic Ocean	• High wind energy potential • High wave energy potential • Deep waters (50-200m)	• Limited number of actors • Limited economic interest	• floating platform • multiple energy converters, i.e. wind and waves	• Harsh sea conditions • Mooring system • Economic feasibility • No aqua culture 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 Project (based on project's outcomes)

5 Evaluating the MSP process within the Mermaid project

5.1 Using MSP according to area and type of activity

This principle stresses that it is important to operate within four dimensions, addressing activities (a) on the sea bed, (b) in the water column, (c) on the surface, and (d) the time dimension (EC, 2008)

During the Mermaid project the designs of the MUPs in the different locations took into account the effects of potential accumulation of different economic activities on the sea bed, in the water column and on the surface.

Mermaid focused on the direct impact on the environment at the different production sites. The assessment of the environmental impacts also included considerations of resource inputs including energy, fish feed production, and access to land facilities as well as issues related to the social acceptability of installations and any aesthetic degradation of the landscape

As an example, in the Wadden-North sea site, the impact of the platform on morphology (sea bed) and waves was determined. This was integrated with an assessment of the impacts of seaweed and mussel culture systems on flow, waves and carrying capacity, benthic and pelagic communities and water quality. The reason for this is that Wadden-North sea area is a densely used and vulnerable area.

Another example is the Mediterranean sea where the site location was selected based on a spatial planning tool developed within MERMAID project (Filipponi and Taramelli) that took into account the possible conflict of uses (maritime routes, protected areas, dumping areas or other restricted areas), the constraints related to both renewable energy and fish farm production, as well as water depth and turbidity. Larger scale impacts (longer-term regional scale effects) related to the possible facilitation of invasive species have also been considered (Airoldi et al 2015).

5.2 Defining objectives to guide MSP

Principle 2 stresses that a strategic plan for the overall management of a given sea area should include detailed objectives. These objectives should allow arbitration in the case of conflicting sectoral interests (EC, 2008).

The participatory design process in MERMAID started with an evaluation of existing policies and regulations, relevant for the four sites (Deliverable 2.1) including the question whether strategic plans for the given sea areas already exist. This analysis itself showed the differences in the development of marine planning between Member States.

For instance for the North Sea, detailed spatial plans are already developed. There is a Marine Spatial Plan in effect for the Dutch part of the Wadden-North sea. The area is divided in different sectors where specific functions are allowed. This also goes for the Wadden-North sea site where a wind park called Gemini is planned. In order to get a permit to develop and operate a wind park in the specific area, a detailed plan is required. The *Noordzee Gebiedsagenda* pleas for effective use of maritime space, by figure of speech opening the door for multi-use platforms. In the stakeholder consultations during the three different rounds, issues of policy and planning were discussed. It is noteworthy that stakeholders are less interested in long-term policy plans but are primarily concerned with the rules and regulations put down into actual concessions. Thus, they are keen to emphasize that whereas the Dutch government promotes multi-use in long term policy plans, the concessions for offshore wind parks do not allow for multi-use.

For the Atlantic Water, in the case of Spain, there is an already stablished administrative procedure for marine renewable uses. It integrates different administrations (local, regional and national),

since a marine renewable developments compromise different areas, offshore and onshore. In terms of marine spatial planning and in the case of offshore wind developments, at a national level a coast zonification has been carried out considering environmental limitations. Three different classes have been considered. (1) areas where offshore wind farms are strictly forbidden due to environmental issues and incompatibilities detected, (2) areas where specific environmental studies have to be carried out to be considered for offshore wind uses because some limitations have been identified and (3) areas where offshore wind harvesting is directly accepted.

5.3 Development MSP in a transparent manner

Principle 3 stresses that transparency is needed for all documents and procedures related to MSP. Its different steps need to be easily understandable to the general public. This will allow full information to all parties concerned and therefore improve predictability and increase acceptance (EC, 2008).

To facilitate the participatory process in the four MUP study sites, the MERMAID project developed a cyclical, iterative participatory design methodology, as already addressed in paragraph 4. The focus of this participatory design process was to work together with the users and other relevant stakeholders throughout the design and development process. This participatory process of scoping, envisioning and learning has contributed to more transparency, and a better sharing of information among a wide range of stakeholders in a transparent way.

Open and transparent dialogue increases the chance to achieve broad acceptance for implementation, although there is no guarantee. The MERMAID participatory process involved sharing the knowledge with stakeholders at the earliest possible stage in the planning process. Information was exchanged and discussed about opportunities as well as risks of MUPs. For example, information concerning legal constraints was presented early, already during the first participatory round with stakeholders.

In the Mediterranean case study, for instance, stakeholders had not been aware of certain technical legislations concerning aquaculture, such as a minimum distance to the coast and a minimum current speed. Mermaid helped to communicate and clarify this legal information in a transparent way, and the design process then adapted to these rules.

Equal and fair representation of different stakeholder groups can also be an issue of transparency. If information is not communicated in an open and transparent way, it may not reach all the relevant stakeholder groups but only selected groups. For example, in the North Sea case study, this “biased” involvement has been done intentionally for the first participatory round: Only a few selected stakeholders, offshore experts, were interviewed, in order to focus the initial discussion and to sort out the knowledge base. This was done as a preparation for the second participatory round, where stakeholders from all the six identified different stakeholders groups were invited (see Table 2).

Table 2 Number of North Sea stakeholders invited to participate in MERMAID North Sea case study participatory round 1 and round 2, for each of the six identified stakeholder groups.

Stakeholder group	Round 1	Round 2
Governing bodies/regulators/policy makers as regional, national and European officers	2	8
End users of the MUP, e.g. energy companies and aquaculture entrepreneurs	4	16
Suppliers of the MUP such as cable companies and construction businesses	2	3
Stakeholders from other offshore activities such as fisheries, shipping & mining sectors	0	3
Discourse community, including e.g. (environmental) NGO's, local citizens	0	4
Universities and research institutes	0	4

5.4 Stakeholder participation

In order to achieve broad acceptance, ownership and support for implementation, it is equally important to involve all stakeholders at the earliest possible stage in the planning process. Stakeholder participation is also a source of knowledge that can significantly raise the quality of MSP (EC, 2008).

Marine management and policy literature has repeatedly highlighted that the best way to reach a management objective is to ensure stakeholders' participation in the process (e.g. Röckmann et al. 2012). The focus of the Mermaid participatory design process was to work together with the users and other relevant stakeholders throughout the design and development process. This participatory process of scoping, envisioning and learning has finally resulted in a better understanding of MUPs by all stakeholders.

In all four MERMAID case studies, stakeholders were involved in the design process immediately. Two face to face participatory steps (round table meetings and/or interviews) were organized. The third participatory step was carried out in the form of email interviews, asking stakeholders for their evaluation of the proposed MUP design.

Thanks to the MERMAID participatory design process the MERMAID project has contributed to establishing support for MUPs among the stakeholders and to foster knowledge exchange, and thus also to improve the knowledge base.

However, MERMAID did not include a process for creating ownership nor any guarantee for implementation. 'The Mediterranean case study, for example, had to completely redesign the initial MUP idea. Due to technical reasons, which were understood only during the course of the project, the proposed MUP design moved from wave to wind energy, and thus against stakeholders' preferences. Nonetheless, stakeholder concerns were also taken into by moving the wind platform farther off the coast than originally foreseen.
In summary, feelings/ wishes of non-expert stakeholders should be taken into account, as well as the technical experts' advice.

Regarding participation and representativeness of stakeholders in the MERMAID case studies, it should be taken into account that for some sites some stakeholders are part of the MERMAID project. For instance in the Baltic area and the Dutch area, this makes participation easier and more likely in the future developments of MUPS.

However, decision makers from public bodies and governments were not included as partners or stakeholders in MERMAID. Their participation however is crucial in a MSP process as the ten key principles show, for instance for the next key principle, the coordination between member states could partly be facilitated within the Mermaid project. This has not been the case as the government bodies did not participate.

5.5 Coordination with Member States, simplified decision processes.

MSP simplifies decision making and speeds up licensing and permit procedures, for the benefit of maritime users and maritime investment alike. Coordinated and cross-cutting plans need a single or streamlined application process and cumulative effects should be taken into account (EC, 2008).

MERMAID analyzed the decision making processes in place and viewed whether they speed up or slow down the development of MUPS. It was concluded that in existing regulations and permits, multi-use is still a problematic concept. However, the project was not aimed at improving and simplifying the decision making processes in the different sites. MERMAID is not addressing the real development. The decision making processes are seen as a given. An evaluation and redesign of these processes could be part of a research project

In the Baltic and North Sea cases, an interesting development place. Here we have real developments going on in two sites, which are only theoretically linked to the MERMAID project. In Kriegers Flak, the planning of both the offshore wind farms and aquaculture farm is underway and MERMAID studied the potential for combining these. In the North Sea, development of Gemini wind park has started. The MERMAID project studied the feasibility of adding seaweed production on a conceptual level.

5.6 Ensuring the legal effect of national MSP

MSP should be legally binding if it is to be effective. Also, there should be an appropriate administrative framework in place (EC, 2008).

This principle was not relevant for the dynamics in the MERMAID project. Existing administrative and legal frameworks were a boundary condition for MERMAID. In various parts of the project, elements of the administrative framework were addressed. MERMAID did not aim to suggest a new administrative framework, This would be a good follow-up project.

However although there needs to be integration into national and international law, hesitation is in place. Of course, developers and other users need to know what is allowed and what not and their properties / concessions need to be guaranteed (by law). However, you could debate whether an

extensive framework is needed. Spatial planning on land has become much more modest in different counties (for instance in the Netherlands) than in the past.

5.7 Cross-border cooperation and consultation

Cooperation across borders is necessary to ensure coherence (the OECD argues that coherence is about the overall state of mutual consistency among different policies (OECD, 1996) of plans across ecosystems (EC, 2008).

The MERMAID project started out with researchers from various Member States. There were 29 partners (comprising University and Research centers as well as private companies and stakeholders) from 13 different countries and very different backgrounds (engineers, ecologists, economists and social sciences). This was needed to develop innovative tools and designs for integrating energy and food production.

While at the scientific level there was large cooperation between different partners and nationalities, the trans-boundary cooperation at the site-level process was weak, and participatory involvement of key stakeholders was only restricted to one country per site.

On the level of the case-sites the cooperation was weak: In the Danish case study, only Danish stakeholders were present at the meetings. Also in the Dutch case study, only Dutch stakeholders were present. The Mediterranean case study was a purely Italian study, there was no cooperation at all with Croatia. The Spanish case study was purely Spanish as it is only in Spanish waters where compromised.

The observed synergies between countries is weak from the administrative point of view. However from the private companies' point of view, there are strong links between Spain and Portugal and Spain and France. Utilities, turbine manufacturers among others link the three countries generating cooperation dynamics between technicians and engineering teams that already exists in different countries.

So the conclusion is that cooperation at the level of project is strong with many international participants. At the level of case-studies not so strong.

5.8 Incorporating monitoring and evaluation in the planning process

Monitoring and evaluation are crucial components of MSP (Stelzenmüller et al. 2013, 2015). Stelzenmüller et al. (2013) presented a M&E framework to provide guidance "for data gathering, identification of major management plans, high level goals and (presence/absence) operational objectives, mapping conflicting objectives." An important step of M&E is to select, map, and assess ecosystem components and human pressures. Management effectiveness and potential adaptations to management should also be evaluated. A problem for M&E is that there can be an overwhelming amount of available information – or a total gap of relevant information.

Two principles of knowledge generation were crucial in the Mermaid approach:

a. The principle of non-linear knowledge generation. This principle acknowledges that knowledge is developed in a complex, interactive process of co-production with a range of stakeholders involved (Gibbons et al., 1994; Rip, 2000).

b. The principle of social learning. This principle states that all one can do in complex and uncertain search processes for sustainable designs with no ready-made solutions at hand, is to experiment and learn from these experiments in a social environment through interaction with other actors and learn from each other's behaviour (Bandura, 1971).

Central in the Mermaid approach is the evaluation of the designs by organizing a round table session with all stakeholders (results are reported in Rockmann et al., 2015). Also recommendations were formulated on the basis of qualitative interviews with the researchers and stakeholders involved, an online survey held among the MERMAID participants (academic and corporate) by the end of 2014, and evaluations with the stakeholders after the different steps of the participatory design process (van den Burg, 2015).

5.9 Achieving coherence between terrestrial and maritime spatial planning

The differences between maritime and terrestrial planning and difficulties in their integration have been discussed in the literature (Smith et al 2011). It was beyond the scopes of project MERMAID to develop suitable planning guidance for land and sea systems alongside to provide terrestrial and marine stakeholders with sufficient knowledge and understanding of marine and maritime matters and interlinkages. Therefore the integration of terrestrial and maritime spatial planning at the site-level process was weak, and participatory involvement of key stakeholders was mainly restricted to maritime issues. Nevertheless the project addresses issues that crossed the land/sea boundary particularly concerning the evaluation of environmental impacts and constraints. For example in the Mediterranean sea, efforts aiming at designing MUPs to support or restore important ecosystem processes, functions and services, such as those provided by native populations of canopy-forming algae (Gianni et al 2013, Firth et al 2014), have included consideration of the potential cumulative effects of a variety of land-based and sea based stressors as well as some global climatic stressors (Perkol-Finkel et al 2012, Strain et al 2015). Similarly in the North Sea the need to develop transportation infrastructures and grid connections via the Port of Eemshaven to shore has lead to the need to integrate allocation of space on land and in the sea to avoid overlap with the neighboring army related exercise territory as well as the Wadden Sea (UNESCO world heritage).

5.10 A strong data and knowledge base

MSP has to be based on sound information and scientific knowledge. Planning needs to evolve with knowledge (adaptive management). Agree what knowledge base to use. Quality assurance on data and knowledge (EC, 2008).

As a scientific project this principle is embraced throughout the whole project as it is MERMAID's aim. Involving knowledge in the project: from inception phase, technical things and now integrated sites.
The knowledge is laid down in an extensive database and during the meetings much attention is paid to get the knowledge comparable to one another. Quality assurance is provided for.
For the four sites metocean conditions were determined, i.e. wind, wave, water quality and hydrodynamic parameters. Experts on the field of Environmental Impact Assessment were incorporated in the project plan and the analyses were made.

6 Analysis

	MSP principle	Applicability in research project	Relation with MERMAID	Comments
1	*Using MSP according to area and type of activity*	+		The area and type of activity were carefully chosen
2	*Defining objectives to guide MSP*	-	Not an objective of the project, Existing plans are background to design and participatory process	no strategic plan for the overall management of the given sea areas is provided with detailed objectives.
3	*Developing MSP in a transparent manner*	+		
4	S*takeholder participation*	+		Organised as part of the project and consortium
5	*Coordination with Member States, simplifying decision processes*	-	*Not aimed at improving decision making processes*	*No c*oordinated and cross-cutting plans have been made
6	*Ensuring the legal effect of national MSP:*	-		As no plans have been made, the legal aspects and administrative framework are not provided for
7	*Cross-border cooperation and consultation*	-		cooperation across borders has been done on the level of the Mermaid project but not on the level of the case studies.
8	*Incorporating monitoring and evaluation in the planning process*	+		Part of the research design
9	*Achieving coherence between terrestrial and maritime spatial planning*	-		*relation with ICZM* has not been object of the research
10	*A strong data and knowledge base*	+		As a scientific project this was a specific aim

7 Conclusions

This paper set out to explore if the MSP principles can be used in networks governing and developing marine space, such as the MERMAID project, a FP7 EU funded research project aimed at the development of Multi Use Platforms at Sea.The knowledge management and participatory processes involved in a project like MERMAID entails many elements of MSP as stakeholders from policy, science and industries were involved in the integral design.

Looking at the MSP principles, it becomes obvious that the principles with a focus on knowledge aspects and participatory aspects are well covered in MERMAID. This goes for the principles 1,3,4,8 and 10. MERMAID covered many questions and uncertainties on the possibility of multi-use, mostly from a technical and environmental point of view. Policy aspects were generally considered as background information, as a given.

However principle 2, 5, 6,7 and 9 focus on the management and policy aspects of the planning process. Due to the nature of research projects, these are not well covered in the MERMAID project. For example, research projects have no possibilities to set legal standards. Other principles could be used in research projects. Cross border cooperation is a fact of life in science yet the strict character of predefined research objectives and activities makes it difficult to change course during the project. It might be necessary to include partners from bordering countries, but if they are not part of the project team this is difficult.

Therefore five out of the ten key principles, especially that involve knowledge sharing can very well be applied to European research projects that involve a wide range of stakeholders. Because the participatory design process project had its emphasis on stakeholder concerns and technical design questions, the MSP principles related to participation and knowledge creation were relevant for MERMAID. The project does not hand out to policy—makers to give them the tools to make decision on multi-use platforms at sea. In the line of research of multi-use platforms, it is therefore highly recommended to:

1. to involve stakeholders from national and regional governments more explicit in the projects of the future.
2. to achieve more coherence on the legal and governance site of the planning process.
3. to include detailed policy aspects in the projects.
4. to create room for manoeuver in participatory design processes to allow for unanticipated outcomes during the process.
5. to include evaluation and redesign of decision making processes for policy-makers.

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