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Stakeholder involvement in technological design: Lessons learned from the MERMAID and TROPOS projects

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Chapter 2

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Abstract

Shared multi-use of ocean space is associated to overcoming several complex technical, regulatory, financial, environmental and socio-economic problems. In achieving this goal several stakeholders of relevance need to participate in the design and implementation of multi-use platforms. This chapter[9] reviews and discuss the participatory approaches employed in the MERMAID and TROPOS projects. The discussion draws on the methods employed in each case, the objectives and obstacles encountered resulting in useful conclusions for participatory design.

Key words: MERMAID, TROPOS, multi-use platforms, stakeholder engagement

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2.1 Introduction

The European Commission has launched the Blue Growth strategy, being the EU's long-term strategy to support sustainable growth in the marine and maritime sectors. Much is expected from growth of the maritime sectors aquaculture, renewable energy, blue biotechnology, seabed mining and tourism, contributing to the economic growth and creation of new jobs (Stuiver et al., 2012). If this growth takes place, the distribution of marine space will become a delicate issue in European seas. These activities require space. Although the maritime areas are large, these activities often eye for the same sites, close to the coastline with good access to facilities.

This results in competition for space, already visible in (among others) the North Sea area. Solving this problem requires Maritime Spatial Planning and the development of creative and innovative contributions which at the same time can ensure environmental sustainability. One such creative and innovative possibility is multi-use platforms, when two or more sectors join activities in same area, or even using the same infrastructures. While multi-use platforms are accepted as a valuable contribution to Blue Growth, the design and employment of multi-use platforms is complicated. This is due to the fact that they involve multiple knowledge questions, challenges for governance, issues of sustainability, and that they require cross-sectoral cooperation.

To overcome these complex problems – where technical, regulatory, financial, environmental and socio-economic aspects are intertwined - stakeholders need to be participating in the design and implementation of multi-use platforms. This is to make sure that the designed solutions are not developed top-down by science or policymakers but that they built on the knowledge and experience of various stakeholders to come to feasible and sustainable solutions (Wenting et al., 2014; Wenting et al., 2015). Comparable pleas for stakeholder participation are made in the European directives on Marine Spatial Planning (Aitken et al., 2016). A participatory approach replaces linear models of knowledge generation which focus on scientists and engineers in the design of new technologies. Inclusion of stakeholders from different backgrounds can enable handling complex problems with multiple interests and objectives (Stuiver et al., 2012; Pomeroy and Douvere, 2008).

Participatory design values the perspective, knowledge, skills and involvement of different categories of end-users and other stakeholders (Wilkinson and De Angeli, 2014; Murgue, et al., 2015; Simonsen and Robertson, 2012)[10]. Participatory design also embraces the two principle of non-linear knowledge generation and social learning. The first principle acknowledges that knowledge is developed in a complex, interactive process of co-production with a range of stakeholders involved. The second 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 through learning from each other's behaviour.

This chapter compares the participatory approaches employed at the MERMAID and the TROPOS projects that studied the development of multi-use platforms. We describe the approach taken and we relate them to the objectives of participation with the aim to assess if participation was valuable. The chapter draws usefuli conclusions of participatory design, based on the findings of the two projects with the aim to inform future design processes. The remainder of the chapter develops as follows: Sections two and three discus the importance and the approach to stakeholder involvement in the TRPOPOS and MERMAID projects respectively. Section four provides a comparative assessment and last section concludes with useful recommendations for future applications.

[10] Other participatory design studies have focused on a broad range of subjects such as health information systems (Wesselink et al., 2013) and medical devices such as wheelchairs (Berghöfer et al., 2008), but also on agricultural landscapes (Pilemalm and Timpka, 2008).

2.2 Stakeholder involvement in TROPOS

2.2.1 The importance to involve stakeholders

The TROPOS project aimed to develop a floating modular multi-use platform system for use in deep waters with an initial geographic focus on the locations off Crete (Greece), Canary Islands, and Taiwan. The TROPOS multi-use platform system wanted to integrate a range of functions including the transport and aquaculture sectors, leisure activities, and renewable energy production. The so-called Leisure Island Concept was planned for Gran Canaria (Canary Islands), with a combination of solar energy production with offshore leisure activities. For Taiwan a so-called Green & Blue Platform Concept was planned as a future concept. In this scenario 'Ocean Thermal Energy Conversion' (OTEC) was integrated with offshore aquaculture. For Crete, the Green & Blue platform concept was also planned. Different from that in Taiwan, offshore wind energy is combined with offshore aquaculture. A fourth scenario, the Sustainable Service Hub Concept, was located on the Dogger Bank in the North Sea and has been recently included in the scope of TROPOS (Wenting et al., 2014).

Stakeholder involvement in the TROPOS Project focused on social acceptance. Social acceptance is recognized as a crucial issue in shaping a widespread and successful implementation of novel technologies and infrastructures. Research on other developments (such as offshore wind farms) has demonstrated that local opposition can delay and prevent developments; and, conversely, where the public and key stakeholders are engaged and consulted, this results in a better project, which can demonstrate an understanding and awareness of the local geographical, social, economic and political context (Aitken et al., 2016).

In the TROPOS Project, social acceptance was regarded as a dynamic process driven by various and alterable values rather than being based on static 'facts', which also refers to issues of power, procedural justice, governance, communication and engagement (Haggett, 2011; Hall et al., 2013). Since the TROPOS platform was meant to be relatively close to the shore and since the concept included offshore solar, wind farm and OTEC, valuable lessons on social acceptance can be drawn from the rich literature on acceptance of offshore renewables. In the TROPOS study, the concepts of Leisure Island Concept off Gran Canaria and the Green-blue Concept off Liu Qiu Island Taiwan were used as examples.

2.2.2 Stakeholder groups

Stakeholders were identified as those who will be likely affected by the development of the multi-functional platform and whose interests and concerns should be taken into account in the planning of large-scale offshore platforms. The stakeholder groups comprised members of the following groups: local and regional governments, fishing and shipping communities, Local businesspeople, local tourism and leisure industries, environmental organizations, and coastal communities

2.2.3 Activities performed and their outcome

The TROPOS project made use of a combination of qualitative and quantitative approaches when involving the relevant stakeholders. Firstly, the potential socio-economic impacts were identified from the literature. Six main socioeconomic impact categories listed in Vanclay (2002) were used in the TROPOS case studies as they are commonly used both in literature and practice. These include health and social well-being impacts, quality of living environment impacts, economic and material well-being impacts, cultural impacts, family and community impacts, institutional legal political equality impacts. Then the impacts were adjusted for each case study during the survey in the local area to fit the local situation better.

Secondly, the strategies for data collection were developed. As the methodology and the choice of methods for data collection should always be guided by the specific situation, the acquisition of empirical data was uniquely created for each case. That is, for Leisure Island Concept off Gran Canaria,

TROPOS adopted a mixed method approach which comprise of a face-to-face survey and a semi-structured questionnaire survey with local people and tourists as well as in-depth interviews with stakeholders who are potentially affected by offshore developments. As far as the Green & Blue Concept off Liuqiu Island Taiwan is concerned, TROPOS used a face-to-face survey for local people and members of fishing industry. These changes were particularly made to shift the focus away from tourism to put more emphasis on local residents and members of the fishing industry as more significant stakeholders. Thirdly, a pilot survey in each case site was carried out in a smaller scale to check whether the initial questionnaire design needed to be changed to the local condition.

Finally, a final survey was carried out for each case and these results were analysed. In the survey and semi-structured interviews, the following aspects of social acceptance were investigated: knowledge and awareness of the project, support for the project, perceptions of socio-economic impacts, perceptions on sustainable tourism, biodiversity and contrasting environment concern, likelihood to visit to leisure island, and how tourists willingness to visit the area will be affected by the platform.

2.2.4 Results of stakeholder involvement

The results from Gran Canaria showed that there are concerns besides a general high acceptance of the Leisure Island among tourists as well as residents. Benefits for the tourist sector which are predicted to result in an increase of income and generation of jobs become confronted with various potential environmental impacts, in particular the disruption of marine species and habitats.

The results from Liuqiu Island Taiwan also demonstrated a generally high acceptance of the Green & Blue platform among residents and tourists, although most participants had been unaware of the project. Despite the general acceptance of such a project, people also raised a number of specific concerns. These concerns are predominantly related to environmental impacts and unclear effects on local fishing and fish processing industries. Other issues that challenged the acceptance of the project include uncertain environmental impacts and adverse effects caused by the operation and construction of the platform. Perceptions of negative impacts were balanced against potential benefits for tourism, which is a crucial economic driver for Liuqiu Island.

This calls for a further examination of local concerns and how people make sense of the interplay between the use of the platform and existing fisheries in order to determine how both may inform, complement and exclude each other.

2.3 Stakeholders involvement in MERMAID

2.3.1 The importance to involve stakeholders

The MERMAID project had the aim to develop concepts for the next generation of offshore activities for multi-use of ocean space. The project did not envisage to actually implement these activities, but it examined new design concepts for combining offshore activities like energy extraction, aquaculture and platform related transport at various areas in the ocean. In order to achieve this, the MERMAID project put the integration of technical, economic, ecological, spatial and social aspects at the heart of the development of MUPs in two ways. First by analysing and integrating all these aspects in the design, and second by involving stakeholders in the entire design process. For the latter, a participatory design process was developed (Rasenberg et al., 2013). The focus of the participatory design process was to work together with the users and other relevant stakeholders throughout the design and development process. For this purpose, a participation process was executed throughout the MERMAID project that focusses on a cyclical, iterative and participatory process of scoping, envisioning and learning through which a shared interpretation of MUPs was developed and applied in an integrated manner.

2.3.2 Stakeholder groups

A group of representatives of all major types of stakeholders were invited for the interviews and round table sessions, where six stakeholder categories were identified: governing bodies/policy makers such as regional, national and European officers, end users of the multi-use platforms, e.g. energy companies and aquaculture entrepreneurs, suppliers of the multi-use platforms such as cable companies and construction businesses, representatives of other offshore activities such as fisheries, shipping, and mining sectors, civil society, including e.g. (environmental) NGO's, local citizens, and universities and research institutes.

2.3.3 Activities performed and their outcome

The participatory design was developed to involve various stakeholders, with different backgrounds, in the design of a multi-use platform for a specified site. The participatory process was thus performed four times. The four case studies were chosen during the first phase of the MERMAID project. They differed not only in terms of the geophysical characterisation, the degree to which multi-use was discussed before the project also differed. The four sites were: The Baltic Sea - a typical estuarine area with fresh water from rivers and salt water, where multi-use was discussed before; the transboundary area of the North Sea and Wadden Sea - a typical active morphology site, where multi-use was discussed before; the Atlantic Ocean - a typical exposed deep water site, where multi-use was not discussed before; and the Mediterranean Sea - a typical sheltered deep water site, where multi-use was not discussed before.

Figure 2.1 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 organised in three steps as follows: first prepare the designs by identifying the views and needs of all stakeholders: this was done through interviews (Rasenberg et al., 2013); then give inputs for the design of the multi-use platform organising a round table session involving all stakeholders (Röckmann et al., 2015) and finally evaluate the design by organising a round table session with all stakeholders (Röckmann et al., 2015).

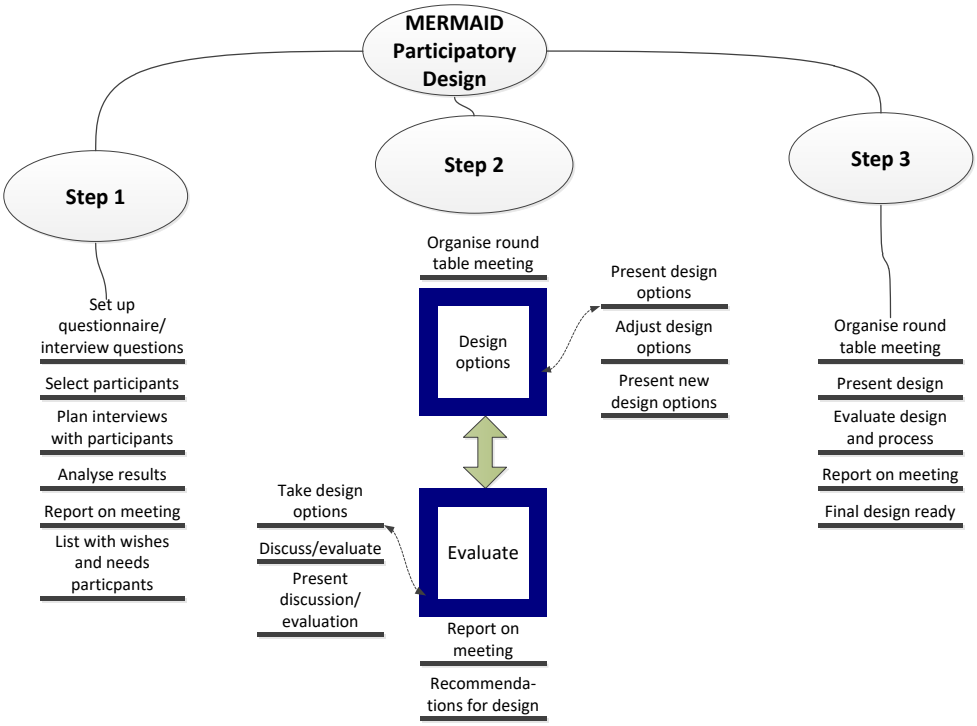

Figure 2.1.: Overview of the MERMAID participatory design process

The work performed in the participatory process did not aim to make a final design, but to organise the input of the stakeholders that can be used to make the final design. The final design was the responsibility of the site managers (each of the sites has a site manager) for the different case studies. The site managers also played a crucial role in organising the three steps of the participatory design.

The first step took place in 2012 and the results of this step are reported in Rasenberg et al. (2013). In the first step, interviews were held with representatives of a wide range of stakeholders. First step focused on identifying different views on ecological, economic and social objectives of multi-use platforms, 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 design options. These design options were discussed later in the second step in an interactive round table session involving all relevant stakeholders.

The second step constituted of an iterative cycle where draft design options were presented and developed. The information provided valuable input to the designers that were responsible for the final design. Based on the discussions in the round table sessions on these design options with regard to ecological, economic, social, technical and governance aspects, the design options were translated into a final design concept.

Last step constituted of a round table session where the final design concept was evaluated with the participating stakeholders. This ultimately led to a design concept which was thoroughly analysed, technically feasible and preferably supported by all the stakeholders represented at the round table.

2.3.4 Results of stakeholder involvement

The MERMAID project focused on four case study sites representative for European waters, each with local challenges. The case studies differed not only with respect to physical aspects, but also with respect to Marine Spatial Planning, current planning of offshore wind development, aquaculture activities, and governance. The involvement of stakeholders also differs at some sites several stakeholders were part of the MERMAID project (e.g. the Baltic site), whereas in other cases there were no local projects partners that also were stakeholders (e.g. the Mediterranean site).

The involvement of the stakeholders resulted in four different designs for multi-use platforms at sea. The outcome of the design process, which stakeholders were present and how the participating stakeholders' concerns were taken into account is described in greater detail in Rasenberg et al. (2013), Rasenberg et al. (2014) and Röckmann, et al. (2015).

The results of the North Sea showed that stakeholders who had a relation with this area – for current and potential future uses - were identified and the following stakeholders participated: offshore wind farm developers, seaweed and shellfish aquaculture fisheries, regulators and policy makers, offshore construction companies, companies interested in the end-product of the design, and NGO's. In collaboration with the stakeholders, offshore wind parks combined with seaweed and mussel aquaculture was identified as the most promising conceptual multi-use design. The final design did not fully integrate the aquaculture structures inside the wind farm, but instead in the areas just outside of and in between the wind farms.

Many of the participating stakeholders could see benefits in participating in a multi-use platform e.g. with regard to more efficient use of space and functional synergies. The idea was not new to stakeholders and their discussion focused on optimization with regard to sharing infrastructures to reduce O&M costs and create win-win solutions. To increase employment and support the fisheries sector, their vessels, possibly redesigned, as part of an infrastructure was seen as an important aspect to consider. The biggest challenge for the North Sea site was to find solutions that could be profitable for all stakeholders, including risks and extra insurance costs. The wind energy developers were very clear regarding the conditions for design: multi-use should not cause any hindrances for wind turbines or obstacles for

operation and maintenance activities. Furthermore, it was stated that in order to find investors, the license procedures need to be aligned for multi-use, i.e. faster than today, and uncertainties need to be minimized (Burg et al., 2016).

The results of the Mediterranean showed that stakeholders included the energy sector, aquaculture, policymakers and environmental authorities. The final design for the Mediterranean site included grid connected wind turbines combined with fish farming. In the layout, the fish farm is placed in the space among the wind turbines, leading to a total occupied space of 0.64 km^2 (Röckmann et al., 2015).

A number of stakeholders initially opposed to the idea of including aquaculture farms in the multi-use platforms, because they were afraid of competition with the already existing coastal aquaculture. Despite this fear of competition, the design team decided not to limit the design by this argument, as this essentially was a plea for keeping a monopoly of the coastal aquaculture. Aquaculture was considered and included in the proposed design, since it is an activity that can be combined with the other uses. An additional supporting argument for including aquaculture in the proposed design, was the existence and vicinity of a market for aquaculture products nearby.

In the Atlantic case, the invited stakeholders included offshore energy sector, aquaculture, suppliers to the offshore industry, as well as NGO's and scientists. The final design included a combination of floating offshore wind turbines and wave energy generators. Stakeholders argued for the importance to select a site where conflicts with other interests are minimal, e.g. a platform should be sufficiently far away from the coast, and not cause negative impacts on the local fishing community. Multi-use platforms were considered to be able to provide revenues to both the local fishing community and local businesses. The importance of including marine renewable energy technology in the design, and the benefits of this sector in the area of Cantabria was agreed upon.

During the round table meeting, the aquaculture sector showed interest in the development of a platform. However, after discussions with all the stakeholders, aquaculture was deemed very difficult technically. The discussion identified the need for cooperation between stakeholders for accurate designs. Some respondents provided examples to illustrate its importance: technically well-designed projects can still run into problems. Economic issues were also identified as a way to integrate MUPS in the local society: MUPS development may lead to the creation of new jobs in the area.

In the Baltic case, stakeholders included potential entrepreneurs to participate in the development of a multi-use platform, as well as governing bodies and the shipping authorities. Also, NGO's representing societal values and scientists participated. The eventual design combined wind turbines and off-shore aquaculture by floating fish-cages with trout/salmon production. This combination was interesting given the large-scale development of offshore wind – with subsequent spatial claims and the critical attitude towards nearshore aquaculture.

The stakeholders lifted forward social aspects with regard to the visibility of wind turbines. However, the design and location were such that, depending on the weather conditions, the wind turbines will seldom be visible. The entire wind park area should ideally be designated a cable protection area, and possibly shipping lines which today pass the area need to be altered. Stakeholders discussed technical aspects for design such as maintenance and monitoring, anchoring and transport, and associated risks. A technical risk assessment of the multi-use platforms appeared to be important and guidelines and rules to minimise risks must be developed to ensure the safety of people, vessels, cages and wind turbines. The stakeholders pointed out that there should be no negative effects on ecological conditions, and that the artificial reefs on the wind turbines foundations should be protected as they have positive ecological effects.

2.4 Comparison of the two approaches

We proceed with the comparison of the objectives of participation of the two different projects looking in particular at whether the projects have succeeded in this endeavour. Table 2.1 provides a summary of the approaches.

Table 2.1 Comparison of the participatory design in TROPOS and MERMAID

	TROPOS	MERMAID
Objective	Develop social acceptance of multi-use offshore platform in the local area	Design socially accepted concepts for multi-use platforms
Stakeholders involved	Local and regional government; Fishing and shipping communities; Local businesspeople; Local tourism and leisure industries; Environmental organisations, and Coastal communities.	Governing bodies/policy makers End users of the MUP Suppliers Representatives of other offshore activities Environmental NGO's, local citizens Universities and research institutes
Methodology	A combination of qualitative and quantitative method i.e. face-to-face survey a semi-structured questionnaire survey, and in-depth interviews	Interactive design Interviews Roundtables Collect knowledge and information from the stakeholders. Eventual design was the responsibility of the project team.
Results	Social acceptance of the platforms in both case studies People show concern to the environmental impacts of the platform Stakeholders are positive to the economic benefits generated by the platform	4 designs for multi-use platforms based on stakeholder input Acceptance of design among the stakeholders Understanding of the complexity of multi-use platform development. People show concern to the environmental impacts of the platform

Strong points	The fusion of the qualitative and quantitative epistemologies complemented each other	Design approach useable in context where MUPS were not known beforehand
	Research process gained social acceptance	Broad involvement of stakeholders
		Learning processes on multi-use were given a boost in the areas
Weak points	Need to be mindful to avoid selection bias when finding respondents;	Generic approach should be tailored to different situations in different basins
	Need to maintain a balance of information without biasing respondents one way or the other when presenting information to them	Difficult to make steps towards implementation
		Barriers to 'blue sky thinking" are present in the real life situation
Value of participation	People perceive and ascribe meaning. This is decisive for the successful development and implementation of these infrastructures	Incorporation of local knowledge is important in the designs and learning is encouraged among all the stakeholders.
	Developers and decision-makers need to consider the legitimacy of new design and learn about their potential concerns/challenges	It is a start of bringing sectors together that have to implement the designs in the future

TROPOS project engaged a range of stakeholders in the research strategy. This allowed the scientists to understand the different perspectives of those who had a particular interest in the area, as well as those who chose to visit, and those who lived nearby, using a multi-method strategy which aimed to understand in depth the views of stakeholders, and a breadth of opinion from residents and tourists.

As with all research projects of this nature, finding the right respondents is a key challenge. There is always a risk of 'selection bias'; that those who participate are those who are willing to do so, and that those who refuse may hold views which are different, and which are therefore excluded from the analysis. TROPOS tried to minimise this bias where at all possible, by stressing the very limited involvement (a short amount of time to participate, convenient to the interviewee), and making the research and the project seem as interesting and engaging as possible, to encourage residents and tourists to participate.

Researching a hypothetical development is always challenging also; it is much more straightforward for researchers and participants to discuss something that already exists. Therefore, the respondents were asked about their expectations, and his became part of the analysis. It was also important to give as much information as possible regarding the platforms, without seeming to try and push them in one direction or another in their views. Future research could benefit from projects which were more widely known about or further along in their stage of development, which would make discussing them and their impacts more straightforward.

In MERMAID and it's four case-studies, the involvement of stakeholders has made a valuable contribution to the design of the platforms in the four study sites. In all cases, there has been an exchange of knowledge, interest and at least a start in bringing different sectors together. Dominant concerns – such as the weather and wave condition in the Atlantic site – were brought to the table and could be addressed in the designs.

A weak point of the approach taken is that the current status quo – whether that concerns market organisation, technologies available or fit with policy objectives – proved to very influential in the design process; e.g. the Mediterranean stakeholders were reluctant to include aquaculture in the design because aquaculture is nowadays dominated by coastal aquaculture entrepreneurs. It proved to be difficult to apply 'blue sky thinking' to these cases.

The most valuable lesson is that the role of stakeholders will differ per case and that consequently the selected approach should be tailored to the situation. In the Baltic site, a predefined group of MERMAID participants sought to discuss the feasibility of realising a multi-use platform at a specific location. This is different from the Atlantic and Mediterranean sites, where the idea was unknown beforehand, and the process was aimed at bringing together stakeholders to explore the potential of multi-use platforms at these locations. The North Sea site was in between; even though the site was predetermined the stakeholders embarked in a process to better understand each other's needs in developing multi-use platforms at the specified location.

2.5 Concluding remarks

MERMAID and TROPOS point to the importance of a thorough consideration of stakeholders' concerns in design processes to take economic actors, government, local citizens and others on board, to legitimize the project and to integrate the platform more effectively in the local context. One has to consider that therefore, stakeholder involvement requires a considerable investment from all the participants in the project.

When setting up participation, different choices need to be made in different stages of stakeholder involvement. For instance, if the process is aimed at closing the deal, as was visible in the Baltic case study of MERMAID, one needs to do other actions, then when the aim is to make stakeholders aware of the potential of multi-use, such as in the Atlantic case study of MERMAID, or in the TROPOS projects. It is important to investigate what project phase applies to the proposed site, e.g., identifying a business case, exploring options to 'add' functions to a planned development, or investigating the idea of multi-use platforms from scratch.

It is very important to know the situation and conditions of the site under consideration –e.g. what technologies are at all possible. Therefore, members of the team need to invest a lot of time in understanding the locality of the case studies. In the future, other projects should provide the necessary resources for creating this understanding of the locality as it is crucial for identifying the relevant stakeholders, their roles, objectives and resources.

When eliciting stakeholders' view, selection bias should be avoided during both the preparation and interview stages. It is recommended to involve the relevant set of stakeholders for specific decisions. In early exploratory project phases take stock of differing views of the stakeholders. In a technical scoping phase, it makes sense to only involve a small group of relevant experts. In later project phases, stakeholders should be asked to pronounce themselves on few and reasonably well-defined design options that are possible for the specific offshore multi-use platform.

Finally, shared knowledge and experience can contribute to more efficient and sustainable designs of offshore multi-use platforms. Acknowledging the stakeholders' perspectives enables surpassing potential obstacles and adjust the design process is necessary. On the contrary, no dialogue or not considering stakeholders´ point of view, leads to risk of inefficient processes, the need to repeat procedures or even implement sub-optimal solutions.

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