





CSA OCEANS

JPI Oceans support action

SEVENTH FRAMEWORK PROGRAMME

Foresight for JPI Oceans - Definition and Review of Relevant Processes

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Foresight for JPI Oceans

Definitional report and review of existing foresight processes relevant to JPI Oceans

Contents

1. Introduction

Foresight has been applied in many different ways and contexts in the past. It is thus not a unitary concept with a narrow definition, but it can mean slightly different things to different people. The aim of this descriptive report is to create a common and shared understanding of the foresight concept among the CSA Oceans partners, and ultimately among the members of JPI Oceans. Furthermore, it provides a basis for discussion about the type of foresight JPI Oceans could be willing and able to coordinate. The report is therefore the first step towards the overall aim of Work Package 7 of designing a foresight process to support the development of JPI Oceans well beyond the lifetime of the CSA project. The report proceeds to provide such common understanding and input for discussion in the following way:

Chapter 2 of the report seeks to develop a common definition of the concept of foresight. After elaborating on the different elements that foresight comprises (section 2.1), the report goes on to outline the different phases a foresight process passes through (section 2.2). Subsequently, the report develops a typology of foresight exercises on the basis of three principal criteria (section 2.3), before delineating the specificities of carrying out a foresight process in a transnational setting (section 2.4). Chapter 3 then reviews some existing foresight processes in the European marine and maritime fields in order to illustrate how other international organisations have used foresight and further assess some of the implications of these processes for JPI Oceans. The sub-sections that follow provide and indicative overview of foresight-related activities already being conducted – groundwork (section 3.1), strategic research agendas (section 3.2) and visions for the future (section 3.3.) – before actual foresight processes are examined (section 3.4). Finally, chapter 4 looks at some of the limitations and opportunities related to foresight processes as well as their specific context within JPI Oceans.

2. Definition

In the context of JPIs To Co-Work, foresight is by and large conceived to be a process that tries to think, debate and shape the future (Kubeczko and Whitelegg 2012: 6). However, foresight has been applied in a variety of different fields and sectors in the past and thus exhibits manifest differences in terms of scope and scale, methods used, the forms of outcomes developed, etc. It is hence not a unitary concept with one distinct application, but rather an overarching notion with varying instantiations. Nonetheless, it is possible to identify a set of characteristics which all types of foresight have in common. A growing consensus is emerging in the academic literature and among foresight practitioners about which characteristics feature in this set and what exactly foresight entails. Such shared understanding exists notably with regard to the objectives of foresight, the process of how these objectives are attained and where foresight is positioned both in the decision-making process and compared to other forward-looking activities.

2.1 The elements of foresight

A widely cited definition of foresight has been put forward by the Foresight for Regional Development Network (FOREN), a project financed by the EU's Fifth Framework Programme on Research with the aim of establishing good practices in the field of Foresight. This definition also forms the starting point of the Online Foresight Guide[1] published by the European Commission's Joint Research Centre (JRC) and the Institute of Prospective Technology Studies (IPTS) and will henceforth be used as the definition of foresight in this report:

> Foresight is a systematic, participatory, future intelligence gathering and medium-to-long-term vision-building process aimed at present-day decisions and mobilising joint actions [...] Foresight involves bringing together key agents of change and sources of knowledge, in order to develop strategic visions and anticipatory intelligence. Of equal importance, Foresight is often explicitly intended to establish networks of knowledgeable agents, who can respond better to policy and other challenges. (FOREN 2001: 3)

According to this definition, foresight comprises five key elements. Firstly, foresight, as the name suggests, has an orientation towards the future. It seeks to anticipate future developments and needs, such as research gaps and priorities as well as technological requirements, by analysing current trends and projecting these onto the medium- to long-term. Foresight considers numerous alternative futures and seeks to generate an understanding of which futures are possible, plausible, probable and preferable (Voros 2003: 15). Foresight thus includes not only an exploratory element, i.e. it tries to understand how the future is likely to pan out given current trends and developments, but also involves a normative component, i.e. it considers how the future ought to look like and what kinds of futures are desirable. Foresight therefore implicitly assumes that the future is not pre-determined (IPTS and JRC 2007) and is at least partially shaped and constructed by human beings (Hideg 2007: 37). Importantly, this forward-looking and intelligence gathering is undertaken in a structured and systematic way. Rather than simply constituting a loose brainstorming exercise, formal methods are employed in the foresight process in order to collect, structure and synthesise information about the future. Which exact methods are used in this process varies from foresight exercise to exercise, as will be elaborated on later on; however, all foresight processes make use such of formal techniques (FOREN 2001).

Secondly, foresight is an interactive and participative process. Contrary to classic top-down decision-making by experts, foresight aims to consult and involve a wide range of stakeholders. Not confining itself to a small policy elite, foresight draws upon the expertise and knowledge of a large number of participants including scientific experts and policy-makers as well as industry representatives, members of civil society, and in some cases even ordinary citizens. This diversity in

[1] The Online Foresight Guide has been developed in the context of the FOR-LEARN Project financed under FP6 with the aim of improving access to foresight knowledge and promoting foresight in Europe. It has also been taken up by the JPIs TO CO-WORK project. The guide provides easy access information on the design, implementation and follow-up of a foresight exercise as well as a number of practical tips and advice. For more information visit: http://www.forlearn.jrc.ec.europa.eu.

stakeholders is also reflected in the kind of expertise which feeds into the foresight process. Foresight does not only build upon the specialised knowledge of the policy community in which the exercise is undertaken, but also considers wider socio-economic trends which might have an impact upon future needs and developments in the field. The foresight process and the anticipatory intelligence it generates are thus multidisciplinary in nature. The insights developed in the foresight process are then disseminated among a wide audience who is encouraged to comment and feedback on the results (IPTS and JRC 2007). Both this feedback and the results of the exercise are subsequently fed back into the foresight process itself as inputs. During this iterative process, the anticipatory intelligence about future developments and needs and information about research gaps and priorities are continuously updated. Foresight is thus a participative, interactive as well as an iterative process.

Thirdly, foresight aims to forge new and lasting networks among its participants. These social and business networks which are created in the process foster an exchange of information between actors from different institutions who are trying to shape the future together. Such networks allow the participants to develop a collective understanding of the "challenges and opportunities they are liable to confront, and the strategies and objectives that others might pursue" (ibid.). Furthermore, the creation of these networks aims to establish a community of "knowledgeable agents" who strive to jointly shape the future and who, in the process, increase their receptivity to change enabling them to enhance their capacities to react and respond to new challenges and developments (FOREN 2001: 5). This networking is often given considerable importance in foresight exercises. While these networks might not be able to deliver tangible results overnight, they are intended to persist beyond the duration of the exercise and can contribute to ensure that the insights of the foresight exercise continue to be applied in the future in a coordinated fashion.

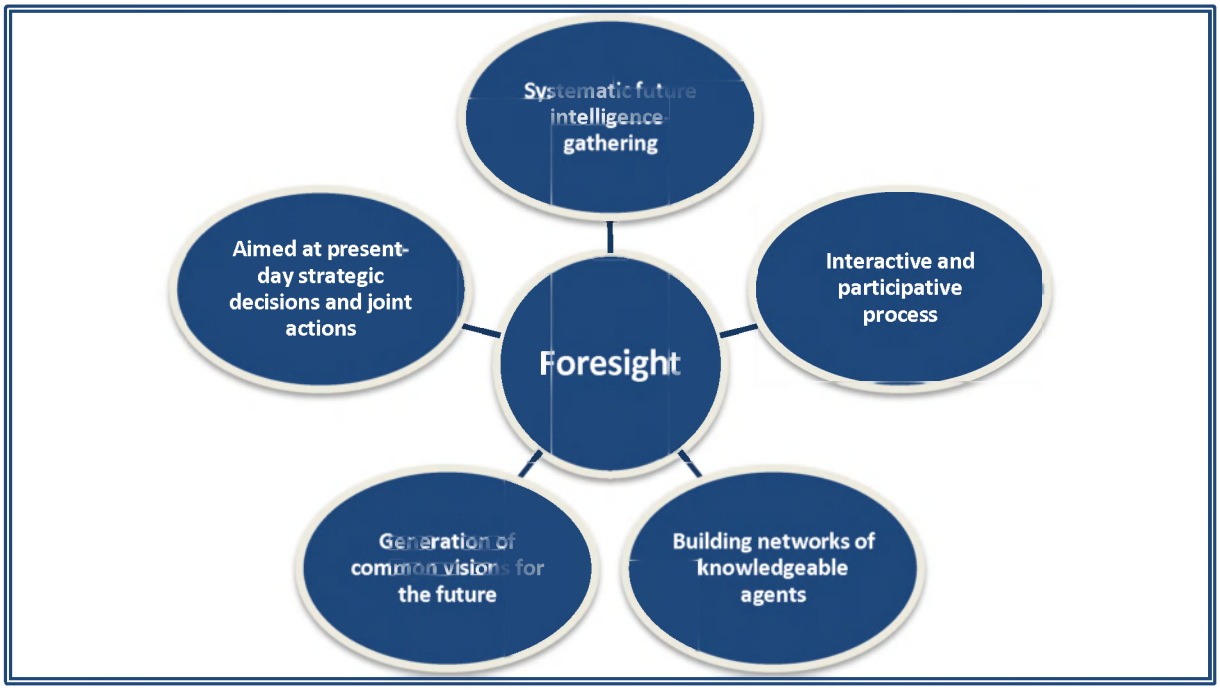

Figure 1 The five elements of foresight

Fourthly, and arguably most importantly, foresight helps to develop visions for the future. One of the key objectives of a foresight exercise is to generate a shared strategic vision among the participants about what the future should look like and an understanding of the challenges and necessary steps that need to be taken to realise such vision. The fact that the foresight process is participative helps to develop both a sense of ownership and a sense of commitment to this vision among the participants with the aim of encouraging them to work together towards an agreed goal. Foresight can, therefore, lead to the development of a common agenda among the participating actors and contribute to a more wide-spread and hence more effective implementation of policies devised in response to this agenda[2]. The networks that are established during the course of the process can further assist in ensuring that the exercise is not a one-off undertaking, but a lasting endeavour to which the participants subscribe. It should be noted, however, that foresight does not automatically lead to the development of a shared vision; where there are irreconcilable differences, foresight alone will not be able to simply do away with these. Nevertheless, what foresight can do, is to encourage dialogue between the participants which allows them to better understand the positions and plans of others as well as to identify common areas of agreement and potential problems and challenges lying ahead (FOREN 2001: 18).

Finally, while foresight has a clear orientation towards the future, the exercise has to establish the implications of the anticipatory intelligence gathered for the present day. Foresight is not about developing an utopian vision which is impossible to realise, but aims to provide the necessary knowledge and information to guide decision-making today. Foresight is designed to generate insights and intelligence about the future which are then considered and included in the concrete actions and strategic decisions taken today, with the ultimate objective of improving the quality of present day decision-making (IPTS and JRC 2007). The foresight exercise, therefore, needs to be located closely enough to the relevant decision-making process in order to ensure that the generated knowledge can be incorporated in this process. If the exercise is too far removed and there is hence no capacity to act upon the results of the exercise, the rationale for carrying out a foresight exercise is severely undermined (FORLEARN 2001: 13).

Foresight comprises five key elements:

(a) systematic gathering of anticipatory intelligence about the future

(b)) a participative, interactive and iterative process

(c) building networks of knowledgeable agents

(d) generation of common visions of the future

(e) establishment of the implications for present-day decisions and actions

2.2 The different phases of foresight

[2] The assumption behind this idea is again that the future can be shaped, however, that the influence of individual actors is limited. A common vision leading to a more concerted effort on the other hand is thought to amplify the shaping impact.

Foresight is not a single event, but a long process that is embedded – or that at least works best when embedded – in the wider strategic decision-making context. A fully-fledged[3] exercise passes through several distinct phases which as a whole constitute the foresight process. According to Joseph Voros, there are five different phases: one pre-foresight phase, three foresight phases, and one post-foresight phase (Voros 2003).

First of all, there is the pre-foresight phase in which the type of foresight exercise to be carried out is determined (see section 2.3). The principal parameters of the process are defined – the context, scope and scale of the exercise are determined, the stakeholders and participants are identified and selected and their level of involvement is agreed upon. Furthermore, the time horizon and duration of the exercise are chosen. Once these parameters are determined, the foresight process begins.

According to Voros' framework, phase two consists of the collection of the inputs for the exercise. These inputs encompass information about future themes, trends and ideas which is gathered from a wide range of participants. Essentially, in this phase the participants are invited to express their impressions of "what is happening" (Voros 2003: 14). Typical methods employed for the collection of this information are, for instance, *environmental scanning*[4] and *Delphi Surveys*[5]. This information, which tends to be large in quantity and diffuse in nature, is subsequently collated, structured and summarised so that it is more accessible and processable for the participants (Horton 1999: 6-7). The processed information is then fed into phase three, the actual foresight work.

[3] As opposed to shortened exercises which may skip some of these phases, but which only considered to be foresight in a wider sense.

[4] Environmental scanning refers to an activity in which current trends, events and developments are roughly detected and analysed in order to create a first picture of the situation.

[5] Delphi Surveys collect data by distributing questionnaires, usually among experts, asking the respondents about current trends as well as probable and preferable futures in a field. The opinions are then collated and measured and fed back to the respondents whose opinions are once again measured after having been informed about the impressions of their peers. The collected data is then interpreted and summarised in a final report (Green and Stewart 2004: 9).

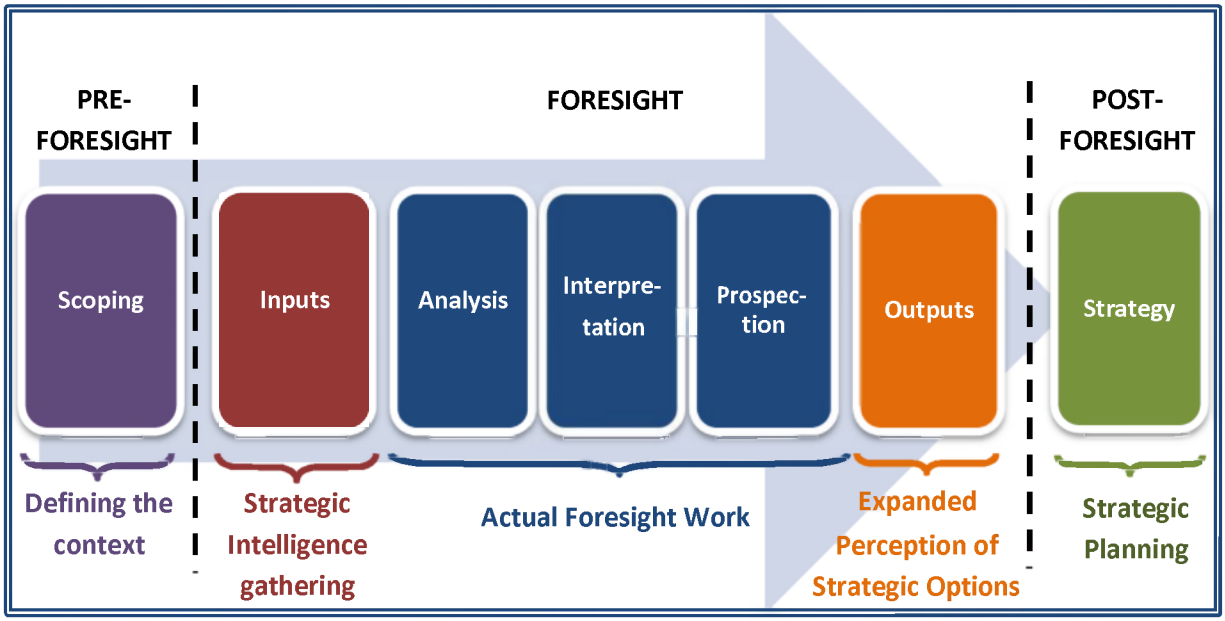

Figure 2 The phases of a fully-fledged foresight exercise (adapted from Voros 2003: 15)

Voros ascribes three different sub-steps to this third phase of the foresight process (Voros 2003: 14-15). Firstly, the collected information from phase two is analysed with the help of analytical methods[6] in order to structure the inputs and make sense of and establish correlations between the trends and developments observed by the participants. The results of the analysis are then interpreted, searching for the underlying structures and dynamics of current developments and creating a proper understanding of "what is really happening"[7]. The third sub-step is the actual forward-looking activity or "prospection". Here, multiple alternative future developments are considered and examined. On the basis of the previous interpretation, possible, probable and preferable future scenarios are analysed and discussed, with the aim of developing a shared vision for the future. [8]

Phase four consists of the production of outputs on the basis of the work carried out in the previous phases. These outputs include *tangible* products such as reports, workshops and presentations which communicate the results of the foresight work. They contain the anticipatory intelligence developed and lay out strategic options, potential constraints and information about desirable futures. These results are distributed among participants and disseminated to a wider audience in order to convey the insights of the foresight process. Other *intangible* outputs are the establishment of networks, changes in thinking and learning effects, as well as the development of a "foresight capacity" among the participants.

[6] Examples of such analytical methods are trend analysis and cross-impact matrices which seek to identify, evaluate and extrapolate trends and developments and show their interdependencies and influences upon each other.
[7] Typical methods during this step are depth approaches such as causal layered analysis, critical futures studies and systems thinking, which aim to reveal deeper, underlying structures, paradigms and world views.
[8] Methods used to create such forecasts are, inter alia, scenario analyses, visioning and other normative methods.

These outputs then feed into the post-foresight phase, the strategic planning. Here, decisions and actions are taken by decision-makers in order to shape the future according to the considerations and insights developed in the foresight process. Voros explicitly separates this implementation step from the outputs of foresight, as the foresight work itself is not responsible for initiating actions and decisions, a task which falls under the purview of policy- and decision-makers engaged in strategic planning (Voros 2003: 13). Foresight merely informs, guides and supports the definition of decision-making by exploring available options and providing anticipatory intelligence about the future. Hence, the foresight work should not be blamed, if no concrete actions and strategic decisions are taken following the exercise; the responsibility to act upon the results of foresight lies with the relevant decision-makers, not with the foresight participants. However, it is, therefore, advisable to position the process close to the decision-makers in order to ensure that the developed insights are taken into account, so that the exercise does not become a superfluous endeavour.

Foresight embedded in the wider decision-making process passes through five different phases in a logical and chronological order

(1) *Pre-foresight:*	Designing the foresight process
(2) *Inputs:*	The gathering of strategic intelligence about future trends and developments.
(3) *Foresight work:*	Analysis and interpretation of this intelligence and its subsequent prospection into the future, considering alternative futures.
(4) *Outputs:*	Production of tangible and intangible outputs disclosing an expanded perception of available options.
(5) *Strategy / Post-foresight*	Implementation of actions and measures by relevant policy- and decision-makers on the basis of the results of the foresight work.

2.3 Types of foresight: matters of degree

As outlined in the section above, different foresight exercises typically follow a generic structure with five distinct phases. Nevertheless, there remains a great variety of exercises as they are set in different contexts and use different methodologies. This section will seek to explain the main areas of difference between exercises and develop a broad typology identifying the various types of foresight that exist.

Foresight exercises exhibit considerable diversity over the different variables that constitute the process. The scope of an exercise can range from the level of an individual company or organisation to the regional, national and transnational level. Consequently, the scale of the operation in terms of number of participants and their backgrounds also varies to a large extent. The scope and scale have an influence on the coverage of the exercise as well. Company-level foresight might be confined to forecasting the development of individual technologies, whereas more ambitious exercises may seek to investigate entire fields of research, sectors of the economy or even

wider areas. Similarly, there are great differences regarding the time components of the exercise – its duration and its time horizon. While some exercises are carried out in a matter of days or months, others continue over several years, especially large-scale operations such as transnational exercises. Time horizons of foresight exercises – how far the activity seeks to project into the future –range from medium-term of five to ten years to long-term of up to forty and fifty years (Porter 2010: 38)

Evidently, there are thus great differences among foresight exercises with regard to scope scale, coverage, duration and time horizon; however, these variables do not offer a basis on which a meaningful typology of foresight exercises can be developed. While these factors undoubtedly have an impact on the nature and procedure of an exercise, similarity between these variables does not necessarily guarantee that these exercises belong to the same type of foresight. Two exercises may, for instance, have the same scope and time horizon yet still differ considerably in their nature.

A more significant classification of foresight exercises can be made according to their design, particularly with regard to the methods employed and the objectives of the exercise. Here three main distinctions can be made between: (i) exercises that are more product-oriented and those that are more process-oriented; (ii) exercises that are more top-down and those that are more bottom-up; and (iii) exercises that use more exploratory methods and those that use more normative methods (FOREN 2001). Note, however, that these categories do not enable a rigid classification of foresight exercises into distinct types. On the one hand, there remain a large number of other variables which may differ between exercises, some of which have been listed above. On the other hand these distinctions are not dichotomies, but matter of degrees, i.e. an exercise is not either completely top-down or bottom-up, but rather to a larger or lesser extent so. Nevertheless, these three distinctions are a good indication of *what* a foresight exercise tries to achieve and *how* it goes about doing this. Each of these distinctions will now be considered in more detail.

2.3.1 Greater product-orientation or greater process-orientation?

Some foresight exercises predominantly aim to develop and deliver formal products, including tangible results such as reports, action plans, videos, workshops, roadmaps, checklists, scenarios and other similar means for the communication of results. These products might be presented to a small group of decision-makers in order to inform specific decisions, but they may also be distributed among a wide audience (JRC and IPTS 2007). Their content varies from more pragmatic and action-oriented recommendations to more visionary pieces, identifying a wide range of options and alternatives. Exercises that are to a greater extent product-orientated exercises tend to be more top-down (see next section) with rigid objectives and methods defined from the outset. Such exercises are relatively easy to assess, the results can be widely disseminated without great difficulty, and they are especially useful when specific inputs are required for a decision-making process.

Process-driven approaches on the other hand place their emphasis on the development of networks and on learning processes which the participants undergo during the course of the exercise. The goal is to "produce" knowledgeable agents who can respond quickly and effectively to changes; who are interconnected and can thus draw on a large network of resources; and who develop the capacity to think strategically about the future and disseminate this foresight culture in their respective organisations (FOREN 2001: 21). These exercises are a lot more difficult to evaluate,

due to the intangibility of the results, and they take a longer time to actually achieve their objectives. Nonetheless, a process-orientation can help to ensure that the exercise does not solely constitute a one-off event, but a lasting undertaking with long-term effects. The networking effect is especially important in fields where there is considerable fragmentation and lack of coordination and coherence between actors.

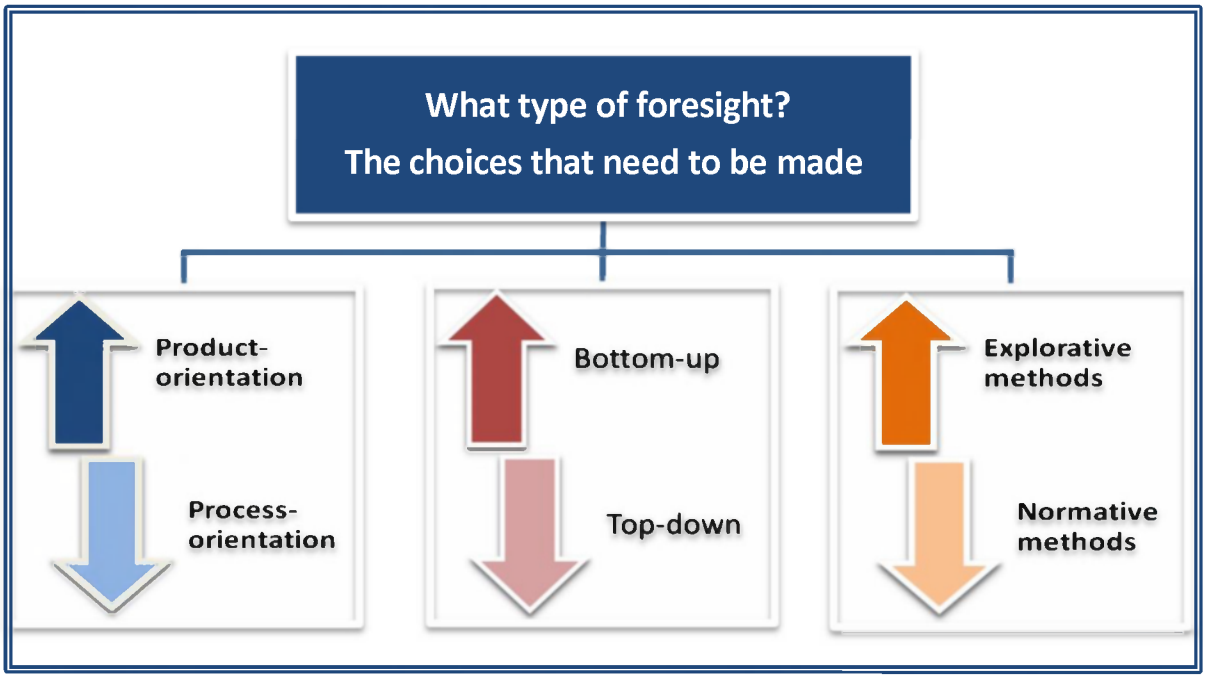

Figure 3 Types of foresight: matters of degree

2.3.2 More top-down or more bottom-up?

Heavily top-down exercises are usually controlled by a small expert group constituted of a range of diverse stakeholders, which also determines the structure and design of the foresight process. While the inputs and information in such exercises tend to be collected from a variety of sources, the interactive component of foresight is pushed to the background, as it is the expert group that processes this information in order to produce the results (ibid.: 19). These exercises tend to have a greater product-orientation and often employ a very formal set of methods for the collection and gathering of intelligence. Such methods tend to rely to a large extent on the expertise and knowledge of certain individuals and on hard evidence for the generation of a vision of the future. Other methods, by contrast, place greater emphasis on creative and imaginative thinking or interaction between participants for such generation (Popper 2008: 65). Such top-down approaches may be used if there are severe time constraints or when dealing with sensitive information (FOREN 2001: 20).

In foresight exercises that are to a greater degree bottom-up, interaction and participation are essential. The decisions on how to define the variables of the process are subject to discussion. The design and structure of the exercise, the methods selected, the scope and coverage, the presentation and dissemination of results, among others, are not determined by a small group, but

participants are consulted and invited to comment on these decisions. As a result, there tends to be a greater sense of ownership of the process by the participants which not only increases the legitimacy of the exercise but can also lead to a stronger commitment to the process and its results. Furthermore, the gathered intelligence tends to come from a wider base and individual expertise is complemented by dialectic and interactive generation of knowledge, which tends to be reflected in the selected methods mix. While there are further advantages of bottom-up approaches such as enhanced process benefits, there are also a few difficulties (ibid.). These exercises tend to be more time consuming, take more effort to organise and given the often wide range of participants, methods have to be selected carefully in order to ensure that information is accessible and understandable for all.

2.3.3 More exploratory or more normative methods?

The last distinction that can be made is between foresight exercises that use predominantly exploratory methods and those that focus on normative ones. Exploratory methods work through extrapolation. They start with an analysis of the present and subsequently map the direction in which current trends and developments are evolving. They also consider the impact of potential exogenous factors and unforeseen events on the trends under consideration. They thus seek to project in which direction the future is moving and what measures can be taken to influence this course. Examples of these methods include trend and cross-impact analyses, modelling and Delphi Surveys. Normative methods on the other hand work in reverse. They begin by developing a desirable future scenario and then consider the necessary steps and resources for reaching this scenario, the possible obstacles and constraints along the way, and which measures have to be implemented in order to guide current developments in the desired direction. A necessary precondition for such an approach is the existence of a shared vision of some kind, or at least the absence of categorical disagreements between the participants, so that such a shared vision can be developed. Examples of such normative methods are relevance trees, backcasting and morphological analyses (ibid.: 26).

Which of these approaches is more effective cannot be defined a priori, but has to be evaluated on a case by case basis. However, as mentioned before, a decision does not have to be made on whether to use exclusively exploratory or exclusively normative methods. Most exercises combine both approaches as they complement and add value to each other, but may put a stronger emphasis on one or the other. The same is true for whether to emphasise a top-down or bottom-up approach or whether to focus on products or processes. As all categories are not absolute but matters of degree, the choices are not ultimate. In fact, foresight can never be exclusively top-down, as it would not be considered to be foresight anymore. There needs to be at least some form of interaction and participation, even if it is only at the stage of information- and intelligence-gathering. Similarly, it is hard to conceive of an exclusively bottom-up approach, as the need to organise, coordinate and synthesise information warrants at least a minimum degree of central organisation, especially in a transnational setting. The same applies to the product-process-distinction. Even if the principal aim of a foresight activity is to build networks and capacities among the participants, this is usually pegged to the generation of some sort of product. And whilst other activities may be geared

to the development of reports or roadmaps, it is most likely that a minimum degree of networking and learning will occur as a by-product in the process.

Each foresight exercise, therefore, has to find the right balance for itself. There is no one-size-fits-all approach since each exercise is set in its own specific setting, embedded in a unique institutional framework with different resources and constraints, with a particular audience and group of participants and with its own particular objectives. This context needs to be taken into account when designing the exercise and when selecting the mix of methods. Careful planning is thus required for the design of an exercise in order to cater to the specific needs of the setting and to ensure that the exercise can fulfil its targets.

Foresight exercises exhibit considerable differences due to the large amount of variables in the design of the process.

Three general distinctions can be made between exercises regarding the desired objectives, the way these objectives are attained and the methods employed:

(1) product-orientation or process-orientation

(2) top-down or bottom-up

(3) exploratory or normative methods

These distinctions, however, are not dichotomies, but matters of degree and thus serve as a general orientation rather than a rigid classification.

Which type of foresight is most effective cannot be defined a priori; each exercise has to decide for itself what kind of foresight best suits its purpose.

2.4 Foresight in a transnational setting

2.4.1 Potential benefits

Carrying out a foresight exercise in a transnational context can yield several benefits, both for the execution of the exercise itself and for the objectives and outcomes of the project. An obvious benefit of a joint exercise as opposed to several individual ones is a reduction in the costs of the exercise by sharing resources and avoiding unnecessary duplications. But the quality of an exercise can also be enhanced if carried out on an international level, since the wider range of participants can help to improve the inputs and generation of anticipatory intelligence by feeding additional expertise and opinions into the process (Amanitidou 2008: 112). Even greater benefits, however, can be derived for the objectives and outcomes of the exercise. Not only can the development of a common vision and the building of networks on an international level – if achieved – help to raise public awareness on international issues, e.g. the seas and oceans, but they can also ensure a wide dissemination and an effective and wide-spread implementation of the results (ibid.). Potential network effects, which are specifically prevalent in bottom-up exercises, include closer cooperation and mutual understanding of the research communities, industrial actors and policy-makers as well

as an active and strong response to common research projects such as joint calls for proposals (Brummer et al. 2008: 493).

Moreover, a transnational foresight exercise has the potential to coordinate and align national research systems and agendas. Haegeman and Könnölä[9] argue such coordination takes place on four dimensions (Haegeman and Könnölä 2012: 200). Firstly, the development of joint visions and research agendas in the course of a foresight exercise helps to align traditionally idiosyncratic and structurally diverse national research systems and practices. Secondly, foresight can foster vertical coordination across governance levels by evaluating previous forward-looking activities at sub-national, national and transnational level. Thirdly, horizontal coordination between policy areas may be augmented due to the multidisciplinary nature of the foresight process and the resulting participation of stakeholders from a variety of fields and sectors. Finally, foresight can lead to greater coordination over time, as joint visions and concrete roadmaps are developed.

2.4.2 Possible challenges and design solutions

Several design considerations for transnational foresight exercises have been put forward which seek to ensure that these benefits are realised and that potential coordination challenges are avoided (Brummer et al. 2011; Haegeman and Könnölä 2012).

Firstly, since foresight usually involves a large variety of participants from different backgrounds who may not all be used to thinking in transnational terms, the foresight process needs to be able to be expanded or reduced in order to account for these differences, i.e. be *scalable* (Brummer et al. 2011: 443). In more concrete terms, the process should be able to allow stakeholders to make contributions that vary not only in size but also in level of abstraction. This can be achieved by decomposing the foresight process into smaller units of analysis, for instance along national or sub-national lines or by dividing it into specific topic areas. However, these sub-processes subsequently need to be synthesised in order to create and develop the large picture and a common vision (ibid.). Since these sub-processes often depend on each other for their success and feasibility, they need to be enacted on time and on budget. Including sufficient slack for each sub-process can help to ensure that the process as a whole is not derailed by problems within one area through unexpected delays (ibid.: 444).

Secondly, as the participants in transnational exercises tend to be geographically apart, the design needs to ensure that all stakeholders are able to participate at all stages regardless of their location (ibid.). ICT tools may offer a potential solution to this problem, since they do not require participants come together in one place at each stage of the process, which can also be a very costly and difficult undertaking.

Thirdly, it should be expected that stakeholder expectations with regard to the foresight process may change over time, with the possibility that some participants may even want to withdraw from the process altogether during the course of the exercise. Including a certain degree of

[9] This study has been presented at the JPIs TO CO-WORK project and can be accessed at http://www.jpis2cowork.eu/images/pdf/embedding-foresight.pdf

flexibility both with regards to the design of the exercise and the presentation of the results can serve to accommodate these changes in expectations and interests of the participants. Rather than rigidly fixing the design and objectives at the start, the foresight process may allow for later modifications in the course of the exercise (Haegeman and Könnölä 2012: 201-202). This may be achieved, for instance, by adopting the process design in individual steps in consultation with the participants and allowing for discussion and reflection between these steps (Brummer et al. 2011: 456). Such flexibility incorporates a certain degree of receptivity to changing expectations and may help to ensure that participants remain committed to the project.

Carrying out a foresight exercise in a transnational setting can yield several benefits for the quality and the objectives of the exercise. These include enhanced inputs, wider dissemination of the results, coordination of national research systems and sharing of costs and resources, among others.

However, potential challenges can arise due to the great variety of participants, the geographical distance between them, and due to changing stakeholder expectations.

Design solutions which may serve to maximise the benefits and diminish these challenges include a scalable and flexible design and the use of ICT tools.

3. Foresight in the European marine and maritime fields

In the European marine and maritime fields, many organisations and institutions have undertaken foresight or foresight-related activities. These activities vary quite considerably and the following chapter is an attempt to develop a rough typology thereof. It aims to provide an illustrative overview of the types of activities that have been carried out by international organisations, ERA-Nets, Technology Platforms and other programmes and projects in the field. Note, however, that this overview does not claim to be exhaustive; it is merely indicative of the types of foresight and foresight-related activities already being performed in the marine and maritime fields. This illustration should, therefore, serve as a basis for discussion about what type of foresight process JPI Oceans is willing and capable of carrying out against the backdrop of what is already being done and what appears to be feasible in the international realm.

The chapter is divided into four sections each describing a broad type of foresight-related activity carried out at the European level: analyses of the status quo, elaborations of strategic research agendas, development of visions for the future, and, finally, actual foresight. Each section provides a brief explanation of what these activities entail, examples of organisations engaged in them, and a short appraisal of their possible implications for JPI Oceans. Note that all the following assessments of the activities conducted by organisations and institutions are only made from a foresight perspective and thus do not constitute general assessments of their work.

3.1. Groundwork – analyses of the status quo

Many organisations conduct some form of analysis of the status quo. While such analysis is strictly speaking not foresight, since the outlook provided is not into the future but into the present, an examination of the current state of affairs is indispensable groundwork for any foresight exercise. When trying to anticipate the direction that the future is moving to, and even more so when trying to influence and shape this direction, a thorough understanding of current trends and developments as well as of the current state of play is a necessary precondition. After all, how can one seek to shape the future, when one does not understand the present?

Broad governmental assessments of the state of the environment constitute the first variation of such groundwork. Thorough environmental assessments are provided on a regular basis, for instance, by the four regional seas conventions with European participation, i.e. OSPAR for the North-East Atlantic including the North Sea and Irish Sea, HELCOM for the Baltic Sea, the Barcelona Convention for the Mediterranean and the Bucharest Convention for the Black Sea. The *Quality Status Reports* (QSRs) published periodically by OSPAR constitute illustrative examples of comprehensive scientific analyses of the state of the health of a sea or ocean; in this case, the North-East Atlantic. These reports are designed as benchmark studies, providing a baseline against which future developments can be evaluated. Not only do they monitor the health of the sea and the current state of the knowledge thereof, but they also assess the impacts of human activities on the marine environment as well as the effectiveness and success of policies being implemented. On this basis, the reports even go a little further by giving indications of future trends as well as identifying priorities for future action; however, these recommendations take on a very broad and general form[10]. Recently, the backdrop of these analyses has been the EU's Marine Strategy Framework Directive (MSFD) with its requirement for an assessment of national marine waters and the normative vision to reach Good Environmental Status (GES) by 2020. It is in relation to this vision that the progress of policy implementation is evaluated. Similar reports are published by the other regional conventions[11]. These comprehensive assessments are often complemented by thematic reports on specific areas, e.g. eutrophication or marine litter, which are similar in terms of analysis.

A second type of groundwork comprises assessments which are narrower in focus and analyse specific sectors or issues. The Scientific, Technical and Economic Committee on Fisheries (STECF) provides systematic scientific advice to the European Commission with respect to fishery resources and trends thereof as well as economic analyses on developments in the fishery sector, including aquaculture. This advice is delivered in the form of ad hoc as well as annual reports. Similar analyses on fishery stocks, albeit on a global level, are conducted in the context of the State of the World Fisheries and Aquaculture series (SOFIA) by the Food and Agriculture Organisation of the United Nations (FAO) on a biennial basis. Other examples of such specific assessments include the EURO Census of Marine Life and the scientific advice provided for the MSFD by the EU's Joint Research Centre and the International Council for the Exploration of the Sea (ICES).

[10] Some specific recommendations include "cooperate internationally to monitor the effects of climate change and ocean acidification" or "reduce discharges into water of hazardous and radioactive substance" (QSR 2010: available at http://qsr2010.ospar.org/en/index.html)

[11] HELCOM's *Ecosystem Health of the Baltic Sea* and its *Periodic Assessments of the State of the Marine Environment in the Baltic Sea Area*; the Barcelona Convention's *State of the Mediterranean Marine and Coastal Environment*; and the Bucharest Convention's *Status of the Environment of the Black Sea* reports.

Thirdly, several evaluations of the state of the maritime economy have also been carried out. Again, a distinction can be made between those studies that appraise the 'blue economy' in its entirety – one example being the recent Blue Growth Study commissioned by the European Commission – and those analyses that address specific sectors of the economy – the consulting firm Douglas-Westwood, for instance, produces market assessments as well as short-to-medium-term market outlooks for the marine energy sector and its sub-sectors such as offshore wind, oil and gas.

Finally, numerous organisations and projects seek to gather and disseminate information on the state of marine science and research. EurOcean, for instance, disposes of large databases comprising detailed information on marine research infrastructures and marine research projects in Europe. Similarly, many organisations have engaged in mapping exercises taking stock of past and ongoing marine research project and programmes.

What the abovementioned list of examples – which is by no means exhaustive – serves to illustrate, is that a wide plethora of analyses of the current state of marine and maritime affairs already exists, including appraisals of present trends and developments. These assessments constitute a valuable knowledge base on which a foresight process can build. Any foresight exercise to be conducted in the context of JPI Oceans should take these accounts into consideration, not just in the interest of avoiding spending much time and resources on gathering knowledge that is already readily available, but also to ensure greater coherence and coordination between existing initiatives and the JPI. Moreover, these assessments not only provide a baseline against which future developments can be assessed, but the provision of a picture of the status quo facilitates both the identification of future challenges and needs (section 3.2) and the development of visions of what the future ought to look like (section 3.3).

3.2. Identifying future challenges and needs – the Strategic Research Agenda

A common procedure in international projects and organisations is the development of so-called Strategic Research Agendas (SRAs), sometimes also referred to as Strategic Research and Innovation Agendas or research priority lists. Generally, SRAs identify gaps in our current scientific knowledge or technological base and infer from these research priorities and needs. They tend to be forward-looking as they provide a list of future research topics which are of particular relevance. Some SRAs are embedded in a wider institutionalised process. They are created in relation to a specific vision that has been developed, by that same organisation or by others (e.g. achieve Good Environmental Status), and can be considered to be 'strategic': they outline the concrete necessary research steps to attain such vision and are implemented through concrete actions such as specific research projects. These SRAs, therefore, have similar objectives to foresight: identifying future challenges and the necessary steps to tackle them. However, the process of their development is often not one of foresight as defined in part one of this document, as they lack, for instance, participative or multidisciplinary elements. Other SRAs on the other hand are only one-off reports which are not accompanied by an implementation process. They may be very broad and vague, be dominated by particular sectoral interests or resemble 'wish lists' rather than realistic lists for research funding.

The BONUS programme appears to fall into the former category, having taken a strategic approach. An SRA with five main objectives and 19 specific themes has been developed for a period of eight years in relation to their vision of an "economically and ecologically prosperous Baltic Sea region where resources and goods are used sustainably and where the long-term management of the region is based on sound knowledge derived from multidisciplinary research". Not only has this vision been developed in close cooperation with stakeholders in a systematic and iterative manner using a multidisciplinary approach, but the SRA is being implemented in an institutionalised fashion. BONUS directly finances a multitude of projects which seek to overcome the research gaps and challenges identified in the SRA. Among these projects, there are some with a distinct forward-looking orientation. The INFLOW project, for instance, uses long-term historical data for the modelling of the future and the development of scenarios of the impact of anthropogenic climate change on the ecosystem at the end of the 21st century. Within BONUS research gaps are thus not only identified, but projects are also launched in order to overcome these gaps. Furthermore, BONUS tries to disseminate its research results widely with a view of informing and supporting the development of relevant policies and has been in close connection to the regional policy and governance structures such as HELCOM, the Council of the Baltic Sea States and the EU Strategy for the Baltic Sea Region.

Another initiative that was founded with similarly ambitious goals as BONUS is the SEAS ERA-Net. It has the stated aim of coordinating the marine research programmes of the 18 participating countries. With respect to content, it seeks to embrace marine and maritime research as a whole, encompassing both disciplinary and interdisciplinary topics. These broad goals have meant that on the implementation side, activities have remained relatively modest. Specifically, SEAS-ERA has articulated Strategic Research Agendas for the Black Sea, Mediterranean and Atlantic areas in addition to publishing a call for projects in the Mediterranean region. To date, no effort has been made to formally coordinate national research policies or agendas.

In contrast to these broad and encompassing initiatives stand organisations and projects that developed SRAs in a more isolated setting without an institutionalised implementation process. Many such SRAs have been developed in the context of an ERA-Net, either focusing on one specific topic or single area within marine and maritime research, such as MARIFISH, MarineBiotech or MARINETEC to name just a few, whereas others focus on a single sea-basin such as the Black Sea ERA-Net. Similar work has been conducted in the framework of projects with the principal aim of devising a strategy for a specific area of research. DS3F, for instance, was set up to identify the major issues surrounding the deep sea and sub-seafloor frontier, such as sub-seafloor drilling and the sustainable use of sub-seafloor resources. Another approach for developing an SRA is the use of expert groups. This top-down approach has, for instance, been employed by the European Commission when setting up an Expert Group on Marine Research Infrastructures with the objective of identifying, among others, gaps and needs in the European research infrastructure landscape.

The problem with this type of activity is that results are not tied to a specific implementation process, a deficiency that many of the aforementioned initiatives exhibit. Such a situation risks devaluating the work that goes into the development of an SRA, as there is no guarantee that the produced knowledge will be utilised or developed further. Moreover, there is also a danger that these SRAs turn into unrealistic wish lists rather than funding priorities, as the authors are not

responsible for their implementation. They may thus have a tendency to include research topics which they desire, rather than those which are realistically implementable. This problem can be further exacerbated when stakeholder involvement in the development of such SRAs is limited to filling out surveys that collect the top research priorities of individual stakeholders, leading the SRA to amount to a mere aggregation of particular (sectoral) interests, rather than an agenda that seeks to promote the common good, or indeed tackle a grand societal challenge.

As the above discussion outlines, a number of organisations have developed strategic research agendas which vary to a great extent with regard to the process of their development, their thematic focus and the wider context in which they are embedded. Three broad consequences can be drawn for JPI Oceans. Firstly, it is important that the SRIA and any future topics and research needs identified in a foresight process are tied to some sort of implementation process in order to ensure that the generated knowledge and results are applied. JPI Oceans has insofar a structural advantage over many other organisations, as it is composed of member bodies which have the capacity and authority to implement results. Therefore, JPI Oceans is not dependent on external decision-makers to implement its results, and thus the danger of conducting a foresight exercise in a vacuum is somewhat limited. Secondly, a strategy and mechanism should be devised regarding stakeholder involvement both in the development of its SRIA and in the foresight process. As indicated above, stakeholder involvement may become tricky if the selected stakeholders are pursuing particular agendas and sectoral interests. This can be especially problematic in the context of defining future topics and priorities. However, this does not imply that stakeholders only constitute a threat. On the contrary, stakeholders can not only provide a range of insights and knowledge, but can also be instrumental in the implementation of the SRIA and should therefore play their part in the process. In order to maximise the value of their contributions, a clear strategy and mechanism should be defined outlining (a) the rationale for stakeholder engagement (b) the procedure for the selection of stakeholders (c) the process or mechanism for their engagement. Establishing what this means in practice will have to be an important task in the forthcoming work of the foresight work package. Thirdly, when considering SRAs developed by other organisations, JPI Oceans should pay attention to how these SRAs have been generated. There exists a plethora of different SRAs and research priority lists, however, only some of them are actually well-conceived. What seems to be lacking in the marine and maritime fields is a strategic discussion and debate about the relevance of the different research gaps and needs that have been identified by the numerous organisations and institutions in the field – a gap that JPI Oceans may wish to fill.

3.3. How the future ought to be – development of visions

Another foresight-related activity that is conducted in marine and maritime fields involves the development of visions for the future. Such activities are closely related to normative approaches to foresight, since they seek to generate future scenarios desirable to attain. As with the SRAs, a distinction can be made between different types of visions which also vary in their relevance for JPI Oceans. On the one hand, there are those visions which are developed in conjunction with an SRA and an implementation plan, thus outlining not only the desired end-goal, but also the necessary

steps for its realisation. On the other hand, there are stand-alone visions which are developed detached from concrete implementation strategies.

One vision which often serves as a reference point is the achievement of Good Environmental Status (GES) for our seas and oceans as proclaimed by the MSFD. The directive specifies on the basis of eleven qualitative environmental descriptors what GES concretely entails, and that Member States are obliged to reach GES for their adjacent seas by 2020. As with all European directives, the process of implementation is not prescribed, only the final state that has to be reached. However, several caveats such as the application of an eco-system based approach to the management of human activities are defined in the legislative text. Moreover, Member States are required to develop concrete action plans for the implementation of the vision, so-called Marine Strategies, which are supposed to take into account existing international and regional cooperation structures. As a result, the implementation process has become a prominent subject for the regional seas conventions. Due to its binding legal character, this vision has become a central focal point and driving force of (international) marine and maritime cooperation and has led to concrete actions being implemented.

By contrast, the Ostend Declaration ("The Seas and Oceans are one of the central challenges of the 21st century") and the more recent Limassol Declaration ("Declaration of the European Ministers responsible for the Integrated Maritime Policy and the European Commission, on a Marine and Maritime Agenda for growth and jobs") are examples of stand-alone visions. Despite high-level political support and noble intent, the absence so far of an accompanying strategic implementation process means that they risk remaining simple declarations of intent, rather than becoming substantial policy and research initiatives. While some of these declarations have been taken up by other projects such as EMAR^{2}RES, which has used and compared these vision documents with other marine and maritime visions in order to identify common challenges and research topics, a lack of institutionalised resources allocated to their cause has had the result that up to now, there have not been many concrete actions that have followed the declarations.

The different vision documents vary in their relevance for JPI Oceans. Binding legislation for the member states such as the MSFD provide a natural point of cooperation, since all member states are obliged to implement its provisions. Simple declarations of intent, by contrast, do not necessarily have an effect on member states priorities. Furthermore, these visions do not constitute examples of what foresight wants to achieve: foresight aims to develop visions, but implications from these visions must be able to be derived for strategic decisions taken today. If there is no possibility on acting on the insights generated by foresight, then carrying out a foresight exercise becomes a superfluous endeavour. Nonetheless, since JPI Oceans is in a position to potentially mobilise resources for the attainment of some of these visions, examining to what extent other visions are congruent with JPI Oceans' own vision document could be a useful starting point for identifying areas of cooperation both within the Joint Programming Initiative and beyond.

3.4. Foresight

As the sections above demonstrate, many institutions and organisations in the marine and maritime fields conduct foresight-like activities; however, only very few actually undertake foresight exercises as defined in part one of this paper.

The most prominent example of an organisation engaged extensively in foresight is the European Marine Board. Its most comprehensive foresight work is the publication series *Navigating the Future* which provides an analysis of the status quo of marine research, identifies future challenges and needs as well as research priorities, and makes recommendations on emerging topics and societal challenges. In addition to this encompassing and systematic report series, the European Marine Board has also produced numerous one-off position papers on specific issues, such as chemical pollutants, marine renewable energy or marine protected areas, which identify emerging trends and developments as well as strategic future research topics and priorities. Furthermore, the European Marine Board also produces vision documents for specific topics, such as marine biotechnology or marine biodiversity, in which they seek to develop a vision for the future as well as outline some necessary steps towards the realisation of such vision.

All of these reports and publications are produced in a top-down fashion. The individual chapters in *Navigating the Future* are written by expert scientists and subsequently peer-reviewed in a relatively informal procedure. Input into the report stemming from outside the scientific community, i.e. from representatives of policy-makers, civil society or industry, is limited and even within the scientific community, expertise is predominantly gathered from a group of select individuals who are the authors of the report. Similarly, position papers and vision documents are drafted by specific working groups of up to fifteen members. While other stakeholder communities are represented in these working groups, scientists usually make up the majority. Moreover, there is little consultation of stakeholders, including other scientists, who are not part of the working groups. As a result, these reports have, perhaps unsurprisingly, a very clear natural science perspective, and the multidisciplinary elements are limited.

The foresight work conducted by the European Marine Board is also product-oriented. The main focus of the work is to produce reports, which are presented to the scientific as well as policy-making communities. The principal aim of the foresight work is to provide an outlook and recommendations on specific marine and maritime issues. Little emphasis is placed on process-benefits, such as building networks of knowledgeable agents – at least not beyond the group of authors – or indeed developing truly common and shared visions which the marine communities can rally behind and feel committed to.

As a consequence of this top-down, product-oriented approach to foresight within the European Marine Board, there is little debate of the issues raised and priorities identified within the reports outside of the scientific community directly associated with their drafting. Hence, the impact of these reports is limited. This can also be explained because on the one hand, these reports are not embedded in a wider structured dialogue or debate, i.e. there is no strategic dissemination process other than simply publishing the reports. On the other hand, the results of the reports are not tied to a specific implementation process, i.e. the European Marine Board does not have funds at its disposal to finance concrete actions or projects as identified in its foresight papers. Instead, they rely

on European and national policy-makers to act on their proposals. So while the European Marine Board engages in a lot of foresight activities and produces reports of high scientific standard, the impact of its findings is limited by the structure of its approach.

Several Technology Platforms (TPs) are also active in the foresight realm. Waterborne TP is one prominent example, but there are other Technology Platforms, such as the European Aquaculture Technology and Innovation Platform (EATIP) and the European Fisheries Technology Platform (EFTP), which have conducted foresight exercises in a similar fashion and a similar context. In Waterborne a foresight process has been implemented in order to develop a vision for 2020. In 2011 a corresponding strategic research agenda and a route map for its implementation have also been published. Rather than constituting one-off reports, both vision and SRA are intended to be updated on a regular basis. Foresight is thus planned to be used in a continuous and iterative manner in order to inform and re-adjust the strategic decision-making within the platform. However, rather than being implemented by Waterborne itself, these strategic documents have been developed with a view of seeking to influence the research agendas of national and European public authorities. The implementation is thus not institutionalised and again dependent on external actors.

Perhaps unsurprisingly, European and national policy-makers have been invited to participate in the exercise. But apart from this group of participants, the overwhelming majority of stakeholders in the Waterborne foresight process comes from the shipping industry. So although Waterborne claims to be interdisciplinary, the involvement of other stakeholders is rather limited. This can be at least partially be explained by the particular context the exercise is set in. Waterborne is a Technology Platform and as such is confined to a specific sector, the shipping-industry and its immediate environment. Composed predominantly of industry representatives, the aim of Waterborne, and indeed of its foresight exercise, is to solve common problems and technological challenges of the shipping sector, albeit with external assistance. The scope of the exercise is thus very clear and de facto determined from the start, and the identified challenges are likely to be shared by many stakeholders.

The context in which foresight will be conducted in JPI Oceans, by contrast, differs in many respects to that of a Technology Platform, as will be elaborated in section 5. So while the work conducted by Waterborne delivers valuable insights into the challenges of the shipping sector, these insights cannot simply be transferred to JPI Oceans, but need to be viewed in the wider context.

4. Existing foresight processes – limitations and opportunities for JPI Oceans

4.1. Some observations on limitations and opportunities

All in all, a few general conclusions can be drawn from the above discussion about the type of foresight that has already been carried out in the European marine and maritime fields. While the overview provided about the foresight and foresight-related activities is only indicative, several trends have emerged.

First of all, the conducted foresight exercises exhibit certain limitations:

- Most organisations do not engage in foresight. While many European organisations carry out foresight-related activities, the number of organisations which have actually implemented foresight processes is limited.
- Most foresight is one-off. While there are a few exceptions, notably the *Navigating the Future* series, the majority of foresight and foresight-related activities constitute singular undertakings.
- Most foresight is (consequently) product-oriented. The aim of most foresight initiatives is to produce reports on a specific issue. Little emphasis is placed on process-benefits.
- Most foresight is top-down. The majority of foresight activities are not based on bottom-up, participative procedures, but are executed by a confined group of individuals.
- Most foresight is not linked to a specific implementation process. Instead, the foresight processes mainly seek to influence the priority-setting of external bodies such as European and national policy-makers.
- Most foresight is limited to specific aspects of marine and maritime research. Few integrated, trans-sectoral and multidisciplinary approaches have been taken.

However, these limitations also offer opportunities for JPI Oceans. The appraisal of existing processes gives an insight into the gaps and shortcomings of foresight processes in the marine and maritime field. When designing its own foresight process, JPI Oceans can not only learn from these limitations, but the gaps in the landscape that have been delineated also reveal possible areas where JPI Oceans can engage in new and complementary activities. Moreover, due to the plethora of existing foresight and foresight-related initiatives, many analyses of the current state of affairs as well as outlooks into the future have already been conducted, which JPI Oceans can draw on and complement. The report also raises certain issues, which need to be considered when developing a proposal for a JPI Oceans foresight process (Deliverable 7.2):

- The multitude of analyses of the status quo constitutes both an invaluable knowledge base which JPI Oceans can use and build on as well as a possible baseline against which progress can be assessed.
- Countless future challenges and research gaps have already been identified. While such issues may vary in their relevance for JPI Oceans, they constitute a useful starting point and input for discussion about the relevant strategic issues which JPI Oceans may identify for itself.
- Similarly, the developed visions can feed into a discussion about the strategic direction JPI Oceans ought to adopt.
- Many potential stakeholders of JPI Oceans have already engaged in strategic discussions about the future. The insights developed in the context of such discussions can inform a JPI Oceans foresight process.
- Stakeholder involvement is an important but not always straightforward issue. JPI Oceans should develop a strategy for such involvement, outlining (a) the rationale for stakeholder engagement (b) the procedure for the selection of stakeholders (c) the process or mechanism for their engagement.

The report thus identifies existing foresight and foresight-related activities from which JPI Oceans can learn, challenges that JPI Oceans needs to address, and opportunities on which JPI Oceans can build. These issues should be incorporated into the development of a foresight process in JPI Oceans. The context in which such a foresight exercise is set in has further implications for the design of the exercise.

4.2. The JPI Oceans context

As discussed in section (2.3), there are several different types of foresight processes and each organisation needs to select the appropriate type of foresight for its own purpose. Foresight is thus not a one-size-fits-all tool, as the process design needs to be adopted in order to fit the particular constraints, requirements and opportunities of an organisation, i.e. the process needs to be designed according to the context it is set in.

As already indicated in section (3.4), the JPI Oceans context is different from many other organisations in the marine and maritime fields. When designing a foresight process, the following particularities need to be taken into account:

- JPI Oceans is a long-term strategic process.
- JPI Oceans tries to solve a grand societal challenge.
- JPI Oceans takes an integrated and multidisciplinary approach.
- JPI Oceans is an intergovernmental process, driven by its participating countries.
- JPI Oceans disposes of the means to implement and fund its activities, through the representatives of the participating countries.
- JPI Oceans is operating on the basis of variable geometry.

JPI Oceans cannot simply adopt a generic foresight process for itself. It needs to find a tailor-made solution for the design of its foresight process which needs to take into account of all of the aforementioned specificities. This will have to be done in the context of the subsequent Task 7.2. "Identification of a topic and process for the test foresight exercise".

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