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SAF PROTOCOL ON COASTAL ZONE SYSTEM OUTPUT (Final)

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GUIDE TO SYSTEM OUTPUT

This is the manual for implementing the Output Step of the System Approach Framework. Readers may not that as part of the overall SAF-guidelines, references to the prior steps of the application are made, and additional readings belonging to these are suggested.

This document follows a manual-structure:

First, a brief overview of the specific task or subtask of the application is given, followed by explanatory and more detailed text.

SSA Examples for the majority of the Work Tasks are found on the Coastal SAF Web Handbook on www.coastal-saf.eu in the Output Step Section, as well as a variety of additional and in depth-readings produced in the frame of the project.

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System Output

1. Introduction

1.1. The Output Step will take you back to the real world

One of the main aims of the Systems Approach Framework is to establish a permanent and effective dialogue between science, policy and stakeholders in your coastal zone by using different tools and forms of communication.

In the Output Step the scientific results that have been received out of the Appraisal Step will be presented to the reference group audience who had initially defined the policy issue.

In the Output Step you will now conduct a Stakeholder Forum to present the results that have been produced in the prior steps. These findings will have to be presented and explained to the stakeholder and policy clientele with the objective of then entering a deliberation process.

A major importance in the Output Step is on the translation from scientific language used in the Formulation and Appraisal Step to target group oriented language. This implies the explanation of the findings in an understandable way for non-modeller and/or lay clientele; referring to the different policy options and the ecological, social and economical impacts of the modeled scenarios.

Some members of the audience will have been involved in the prior steps and might not be starting from a zero point of understanding whereas others will have less knowledge about the process. In the Output Step you will therefore need to reflect different levels of understanding and it will be crucial to recapitulate the process for transparency during your science-policy consultation. This will include explanations about uncertainties, about long term benefits, tradeoffs, data gaps, and more.

The Output Step manual will give you guidelines on how to prepare the science-policy consultations, what needs to be considered when approaching the bigger stakeholder audience and what presentation formats can be used. There will also be guidance for conducting deliberations using a set of deliberation support tools.

1.2. Recapitulate where you are when entering the Output Step

With the Output Step, you are entering the final part of the System Approach Framework (SAF), leaving behind the Issue Identification Step, the Design Step, the Formulation Step, and the Appraisal Step. Let us briefly recapitulate what has been done so far.

In the Issue Identification Step, and the Design Step, you have started a stakeholder involvement process and convened an initial meeting to screen together what policy issues

needed to be addressed in your region. The purpose of this first round of discussion was to collaboratively identify and select a critical policy issue in your region which is both relevant and realistic to address. In the design step, you have drafted a conceptual model that helped you visualizing the policy issue through its different dimensions (social, economic and ecologic) and to show relationships. As a reminder and with relevance for the now following chapter: for realizing these initial steps, you were offered guidelines about stakeholder and institutional mapping, helping you in detecting what interests and actors are involved, and about more complex economic assessment methods and techniques that you may need when drafting the model.

The basics for modelling scenario simulations (available methods and data, most appropriate scales, etc) were now defined. The model was further elaborated in the Formulation Step, as you did formulate the most accurately possible the key processes inside of the coastal system, as well as the inputs and internal interactions. These were assembled into functional ecological, economic and social components and integrated into the model. An essential part of the Formulation Step was to make sure that all data, formulations, scales and interactions you had defined or selected were appropriate.

In the Appraisal Step, you have completed the model by bringing together the three components and by running a simulation in the most efficient possible way. In search for a remedy to the policy issue selected in the Issue Identification Step, you observed the model and interpreted its reactions to the various possible policy options. Accompanied with quality controls and error estimates, this scientific interpretation was the opportunity for an ultimate validation of the process. Now that the simulations are running based on different policy options, you are entering the Output Step.

As written above, in the Issue Identification, the Design, Formulation and Appraisal Step, the implementation entered a virtual world by developing a conceptual design after having defined the policy issue and after doing an initial stakeholder and institutional mapping. The conceptual design reflected the elements of the system with regard to that defined policy issue in order to define a scale and to highlight relationships and influences/impacts before entering the Formulation step and running simulation models in the Appraisal Step. Note that ideally the process never completely left the real world and even throughout the modelling, reality checks should have been done with a reference group.

2. Get ready for scenario presentations

2.1. Prepare your mind, prepare for engagement

For science and policy consultations it is important to first step-back, taking into consideration broader perspectives on relationships and paths of learning between science and policy. This will help inform and improve the quality and usefulness of the stakeholder and deliberation forum. When preparing the scenario presentation, it is essential to go back to what you did in the prior steps of the methodology, because you have to be prepared to refer to this and to show where you came from. For this, reflect on the process by brainstorming within your team and list answers to the questions: What has been learned? and what are the key points that have been the core of your application? You will also go back to the tools used in the Issue Id and the Design Step and pick up those ones most adequate for your presentation. To plan the meeting, you should identify your stakeholder audience and map their interest. Now specify, what needs to be presented. By doing this, always keep in mind general rules and principles of effective science policy practices and make a list which ones are to be considered in particular on your site. Furthermore you should make sure to follow some basic general and ethical rules in order to enhance the quality of your engagement process. When planning your presentation and reflecting on the process, go through these ethical rules. Tick a list whether you followed them.

2.1.1 Science-policy and science-society consultations in the Output Step

By now you know that the SAF methodology attempts to capture, identify and visualize the specific reciprocal effects and impacts of ecological, social and economical development processes in a geographically limited area of a coastal zone.

In the Output Step the information shall now be presented in such way that the context and the variety of perspectives are made clear, and the scientific information appear in a language and interpretations that make them become understandable for different stakeholders. In addition to this, the SAF application imparts knowledge about the method and the limits of modelling, as well as about which interest level, which horizon, style, which way of presenting the information will lead to a possibility of acceptance.

In the prior steps of formulating and assessing the model, only selected stakeholders have been involved to give input and feedback. In this final step however, the scientific results will be presented to a wider audience of stakeholders, managers and policy makers in order to initiate or ideally continue a deliberation process. Now, those stakeholder groups that have

jointly deliberated and decided on a policy issue to be tackled, will be invited again to see the results of the different scenarios which are based on different policy options.

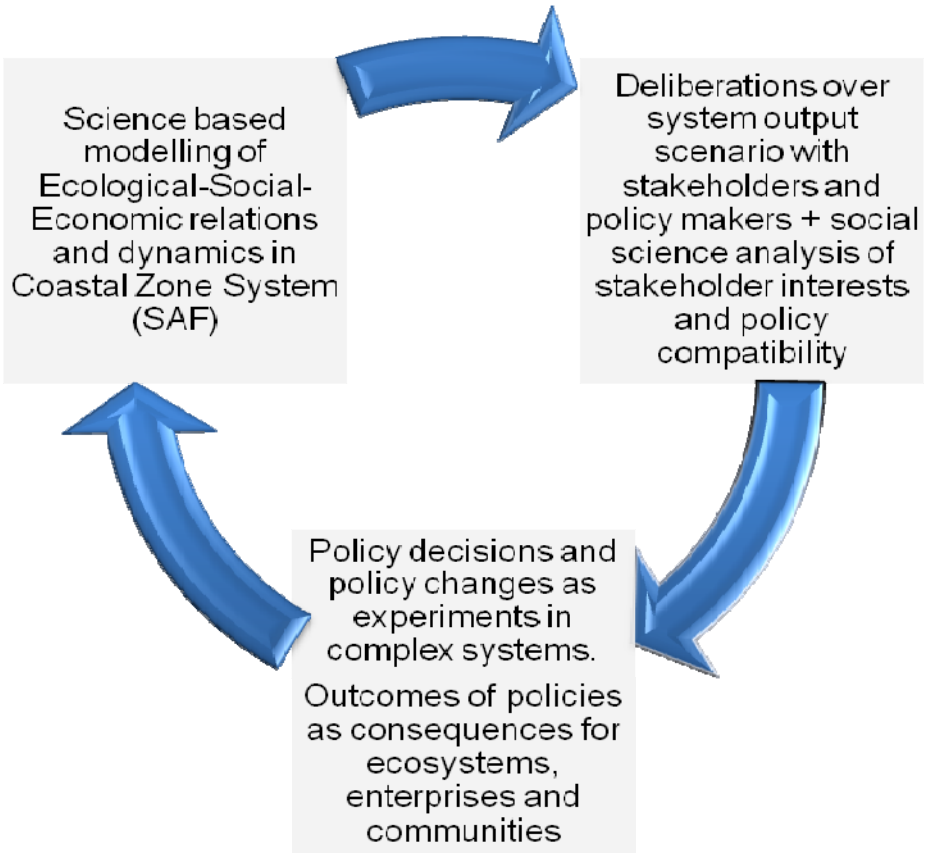

Figure 1) science policy loop in a SAF

In order to utilise the full potential of the SAF methodology, it is crucial that the participating practitioners of the science–policy and science-society consultations fully understand the objectives of the SAF approach: This is to mobilize the best available scientific knowledge on the sustainability of coastal systems and to integrate the ecological, economic and social aspects of this knowledge into one holistic System Approach Framework that will be used to explain the dynamics of coastal zone systems and potential consequences of alternative policy scenarios. This is illustrated in the above figure as an eternal policy making cycle where your contribution to policy-making is found in the upper left corner of the cycle. The model outputs are then taken to the «real world» of human beings who pursue interests, have intentions and are conditioned by social institutions. In the upper right corner of the cycle, the system model output scenarios are then used to consult with the reference group and if possible involve them in deliberations over preferred futures. In the latter case it is important to be aware that stakeholders in the course of deliberation processes gradually become policy

makers with ambitions to influence on the policy decisions and policy changes. Thus, involvement of coastal zone citizens in science policy deliberations has real life political consequences that have to be taken into consideration before starting a science policy deliberation.

When practicing any form of science – policy consultation, it is of paramount importance to communicate clearly that policy solutions reached after a very thorough systems modelling process and a very inclusive policy deliberation process, should not be regarded as «final solutions» , as panaceas that can cure all problems in the coastal zone. This is reflected at the bottom of the above figure where policy changes are seen as continuing experiments in complex systems and where the outcomes of policy decisions are seen as consequences that affect he ecological, economic and social elements of a systems modelling – and thus the basis for a new round of science –policy interaction.

2.1.2. Some principles of effective science-policy practices

When engaging in the communication process with the stakeholders, it needs to be understood that models are as a start not understandable to non-modellers or lay people. They cannot and must not be entirely understandable. The nature of such scientific language is not the language for "presentation" to the broad public. It is a sophisticated communication technique for experts. It is a technique – in which short technical terms need to represent bigger systems and their interrelations. Those technical terms act as symbols. They act as proxies with the purpose of activating existing knowledge in the scientific audience.

Now – in the SAF approach – these same experts will share their knowledge with practitioners and with the public – for the use by stakeholders and for the stakeholder's use in Integrated Coastal Zone Management.

Whilst - as highlighted above - there is no panacea for knowledge-based policy-making; experience has proved there are a number of principles that can provide useful guidelines for better science and policy integration. A series of European workshops on 'Science meets Policy' have explored the challenges and opportunities for making better use of science in environmental policy-making and have provided a number of pragmatic messages (SMP, 2005). These practical viewpoints are presented below with some ideas on how these might influence scientists' practices' during the Output phase of the SAF research process.

Principle	Description	Relevance to Output Step
Opportunities for dialogue	Dialogue not only improves communication, but also mutual understanding. It helps with aspects of knowledge sharing that are widely under-estimated in their importance: familiarity, building of trust, acceptance and informal interaction.	Dialogue and deliberation are central components to the Output Step. As described in later sections, deliberation is a cornerstone of this phase of the SAF and effective deliberation and dialogue provide key opportunities for the effective integration of science into policy. Deliberation involves discussion: it is a two-way process of information exchange.
Dissemination is not dead	Although a style of research should be fostered in which researchers and policy-makers interact throughout, there is still an important role for dissemination especially as policy processes and networks become more diffuse, open and consultative.	Stakeholder deliberation and engagement are processes that have been encouraged throughout the SAF with as wide a group as possible. In this final Output Step, there are clear results and outcomes to present: so that dissemination becomes an important component of the broader dialogue process. At this particular stage there is a clear opportunity to revisit the composition of a stakeholder group and potentially broaden the range of people to whom results are disseminated. This may for instance include stakeholders who did not have the resources or time to be involved for all of the SAF process or engage with the wider community. Broadening from a two-way conversation with a small group of stakeholders, to include consultation with as wide a group of stakeholders as possible – is an important feature of the engagement at the Output Step.
Transparency and openness	Transparency is where the workings of decision-making groups and discussions are made visible and accessible: openness is where these processes bring in a wider range of interested and affected groups than the traditional categories of 'experts' and 'policy-makers'.	Scientists need to be as clear and open as possible about the assumptions and approaches that were used to generate the presented results and ensure as wide a group of stakeholders as possible have the opportunity to hear the results and to read them in the written documentation of the Output Package.
Strength of evidence	'Strong science' presented in a meaningful way, for example, the costs of not addressing the problem and the budget required for implementing these solutions. Researchers need to interact to 'road-test' the viability of any policy prescriptions they are	Scientists should work within both the Appraisal and Output Steps of the process to ensure that the scenarios that are presented as part of the Output Step are as robust as possible and in particular within the institutional, legal and social framework within which they are being presented: this is critical to achieving

	suggesting: processes are required which bring evidence together as well as identifying areas of remaining uncertainty and ignorance.	'meaningful strong science'.
Relevance of research	No-one wants to support 'bad' science, so scientific excellence will remain a central consideration, but the relevance criteria such as significant and urgency needs to be actively considered.	An obvious aspect to consider within this phase of the SAF: the SAF process should be built around a policy-issue that was identified with stakeholders as useful and relevant. It is important to ensure that the relevance of the research (including its problems and assumptions) are clearly presented to stakeholders within the Output Step. Failing to ensure a full and clear interpretation of the project outcomes may undermine the research results and prove to be harmful to science and policy integration.
Problem focus	A focus on real-world problems: this is a necessary distinction because academic disciplines often define research problems in narrow ways; leading to research that is abstract, narrow and irrelevant.	It is at this stage of the SAF process that there is the clear necessity to return to the 'real world' and clearly embed the scientific and modelling results back into the wider context of the site and the coastal zone. Not only will this provide the greatest opportunity for the science to be embedded within any emerging or existing policy, but may also provide additional policy issues within a further iteration of any SAF process.
Inter-disciplinarity	Consistently identified as a priority, yet there remain many institutional barriers to inter-disciplinarity within many research- as well as policy-organisations. This needs to be addressed by researchers, research funders and policy-makers.	When designing and presenting the modelling results it is important to highlight the links between the ESE components. If one aspect is not as represented as well as others within the model or within the scenarios it is important to be explicit about this and how it affects the results. If possible it may be useful to have scientists from different disciplines present to highlight that different aspects of the complex coastal system have been included and who would be available to answer discipline specific questions.
Asking the right questions	This is not merely a chance to enhance communication. Researchers need to ask relevant constituencies 'if we are doing research in this area, what questions would you want answered?'	Asking the right questions is essential at the beginning of the SAF process, but it is also fundamental towards the end; revisiting the fundamental questions of the stakeholders and presenting scientific results that attempt to answer these questions. Therefore, at the output stage it is relevant and recommended that

		scientists return to discussions that were held about the policy issue and the key research questions discussed when selecting it.
Staying independent	It is not a question of whether researchers are affected by policy discourses and priorities but how, by whom and to what extent. It is probably healthier to face up to influences on research than to try to ignore them. If researchers actively interact with the full range of interested groups it enhances their ability to 'see the whole picture', identify salient questions and extreme views.	A key message for scientists when presenting their research to stakeholders: it is necessary to remain as independent and objective as possible. Where there are obvious subjectivities or researchers have not been able to interact with as many organisations as possible, it is recommended that these issues are presented to give a clear a view as possible. This also gives opportunity for discussion on salient questions or views which may not have been incorporated in the SAF approach. It is also important that where possible scientists maintain a 'distance' from the decision-making process. Scientists and other experts have the responsibility of advising policy-makers on the costs and benefits associated to the choices relevant to the decision-making process. The experts' role is to provide information on implications of methods and objectives. The decisions regarding what any management process hopes to achieve and if achieving this goal is worth those costs identified by the expert community is the responsibility of the policy-maker. Where the SAF process is not linked to a policy-making process: this focus on staying independent may not be as critical. However, it remains important when presenting results to stakeholders in the output stage to be clear of the remit and role of the scientific-research led process.

Table 1) Principles of effective science-policy practices (after SMP, 2005)

Suggested additional reading: McFadden, L., Priest, S., Green, C. and Sandberg, A. (2009) Basic principles of science and policy integration, Spicosa Project Report, London, Flood Hazard Research Centre, Middlesex University Available at: http://www.coastal-saf.eu/output-step/refs.shtml

2.1.3 General rules for planning a science-policy consultation

When planning a science-policy consultation, it is important to be aware:

That any science-policy consultation takes place within a certain institutional and governance framework, where certain fundamental socio-ecological relations, (e.g. property rights, cultural traditions etc.) are very difficult to change and must be acknowledged, while other relations (e.g. laws and regulations) can be changed after due political process, and where again others can be changed more easily (e.g. permissions, plans, improvements, investments etc).

That the knowledge of such "constitutional rules" of what is easy and what is difficult to change has been duly mapped throughout the System Approach Framework process and is that it is also shared knowledge among the defined stakeholder groups and policy makers.

That reference is made up-to-date directives and methodologies, such as the, as well as to respective institutional and/or governance frameworks.

That the state of the art of knowledge of the complex costal socio-ecological system is preliminary, uncertain and will never be complete for all tracks of the output process – regardless of the degree of formalization of the ecosystem modelling. Thus the knowledge base for policy decisions is "open towards the future". This is the point of departure for science-policy consultations and deliberation processes.

That the level of participative communication cannot be modelled.

That the assumptions and the parameters used in the modelling exercise preceding this policy consultation, should be transparent (visible) and open to judgement and criticism by the various stakeholder groups.

That the assumptions and parameters of formal models can be changed after first consultations and new simulations can be run on the basis of alternative assumptions.

Therefore, on the background of these simple heuristics, the instructions provided to the Stakeholder Forum and to the Deliberation Forum in the Output Step should not be considered as "the only way" to carry out a science-policy consultation. There is no panacea when it comes to knowledge-based policy making. Policy making should therefore be seen as never-ending experiments on socio-ecological systems, the effects of which should be constantly monitored and evaluated. Science and policy integration is about exploring and deliberating the meaning of 'success' and social goals, about spontaneous innovations that lead to improvements that are not foreseen – and exploring the understanding of the small

variations in human activity that make a difference to the ecological, economic and social sustainability of decision-making.

The instructions in this handbook should more be seen as a guide to get started in a science-policy consultation that can gradually be "taken over" by the stakeholders and contribute to their empowerment in Coastal Zone Governance.
Thus, when science in this way is taken to the policy arena, the outcome of the Output Step is **fundamentally uncertain**.

2.1.4 Ethical rules to ensure a successful science policy integration

In preparing a Science-Policy Consultation there are first of all four basic ethical rules to be followed in order that the Science and Policy interaction can take place in a way that enhances the quality of both, science and policy:
One is that due respect to be given to the local cultural traditions, the traditional ecological knowledge (TEK) and the specific characteristics of a certain coastal location.
A second one is that the ICZM Science –Policy Consultation Process clearly belongs to the stakeholder community; it is the groups here that are going to live with the outcome of such processes, and to live with each other after the external agents and facilitators have left the scene. The scientists and/or modellers need to see themselves in the role as being part of policy making and of citizenship. They have to accept that the political system and the social system exist and they have to be aware about the way these are functioning.
Possible pitfall: If the stakeholders are not sufficiently involved, they will not accept the decisions, they will not re-elect for long-term sustainable policy making approaches and they might never get back into such process again (with the same convenor).
A third rule is that throughout the Science-Policy Consultation sufficient consideration must be given to fundamental human rights and to due democratic rights to participate in policy processes, irrespective of existing power relations. This also ensures that the processes are transparent and legitimate – and efficient in the long run.
A fourth rule is that throughout the Science-Policy Consultation sufficient consideration must be given to preserving biodiversity and the continued functionality of crucial coastal ecosystems, in order to ensure long term ecological sustainability.
You can and should add to this list according to your local and cultural setting.

2.2.Prepare your presentation

To maximize the effectiveness of the outputs of the System Approach Framework, present your information following the KISS rule: Keep your presentation short and simple. Use your creativity to produce information compact (where possible), credible and understandable. Create and follow a coherent structure. Agree and produce a combination of different formats, such as appealing (short) texts and images / image effects (possibly even sounds) Decide thoroughly which aspects of the results are important to be visualized well (and document why). There are a number of social tools that have been introduced early in the SAF's Issue Id and System Design Steps that are particularly useful to revisit within the Output step. The tools are clearly useful at the beginning of the Output Step and in early preparations; however they may also be directly used and referred to during the stakeholder and deliberation activities. Make sure to use these tools such as the institutional and stakeholder mapping, conceptual modeling and where applicable CATWOE and / or DPSIR to illustrate the process.

Decide and structure the duration of your presentation, whilst keeping in mind your prepared presentation material. A suggested structure is the following:

- *Explanation of the objective of the meeting*
- *Recapitulation of the process for transparency*
- *Showing the usefulness (and limits) of scenarios to the stakeholders*
- *General explanation of uncertainties and assumptions*
- *Presenting (running) the scenarios for audience*
- *Explanation of policy options on which the scenarios are based*
- *Comparing Scenarios*

Cooperate with an external professional facilitator and meet with the facilitator before the stakeholder forum.

2.2.1 Why to make sure that the presentation is of good quality?

Because the audience will consist of people who generally lead busy lives. This means that it is not possible to simply give the information to them and then leave them on their own for "digesting" it. Always take into consideration the time factor.

As indicated above: To effectively portray the results of the System Approach Framework it is imperative that we present our findings in such a way that they are:

1) able to catch the complexity of typical coastal systems
2) not so complicated such that the audience cannot understand them

3) comprehensive enough to catch the (contemporary) institutional reality of the coastal system (or in which the coastal system is embedded)
4) of relevance for the audience and that their stakes are reflected as well as impacts that might affect them

We therefore must be careful to present the information from the systems approach framework at a level that can be understood by the audience, be they policy-makers, stakeholders or interested members of the community.

- Always remember to pitch your presentation to the level of the audience, not to the level of the data.
- If your background is presenting findings to an audience educated in your field, for example if you are a scientist and frequently present to conferences, then you must be careful not to present your outcomes in the same way as you would have at these scientific meetings since theories, equations and numbers are often meaningless to the lay audience.
- However equally we must not fall into the trap of assuming that the audience is stupid or uninformed, in all probability they can know as much or more about the subject than you do and probably know it more detailed in practical terms.

Be aware that when speaking with the reference group and when presenting the results to them, it will be essential to have read their relevant documents and be well informed about their interests and opinion. It is helpful to pick up these aspects when presenting and when writing down the scenario results so that the audience / the respective reference group see an immediate interrelation and usefulness for their work and stakes. They will see the need for receiving this information and thus be more interested than if they had not been given the coherency between their interest and the scenario presentation. Of course this includes taking into consideration the institutional frameworks of the possible policy options.

At this stage you will discover if you did a thorough and good work in the first two steps of the SAF application. In other words: the better you did in the Issue Id and in the Design Step, the better you are prepared for the Output Step.

Suggested additional readings: McFadden, L. and Priest, S. (2011) Using social tools in the SAF Output Step, Spicosa Project Report, London, Flood Hazard Research Centre, Middlesex University. Available at http://www.coastal-saf.eu/output-step/refs.shtml

McFadden, L., Priest, S. and Green, C. (2010) Introducing institutional mapping: A guide for SPICOSA scientists, Spicosa Project Report, London, Flood Hazard Research Centre, Middlesex University. Available at http://www.coastal-saf.eu/design-step/refs.shtml

2.2.2 Build Facilitator-Scientist Tandem

For holding a presentation according to these general criteria it is highly recommended to invite a professional facilitator (henceforth called "the facilitator"). The facilitator can be a journalist (with a degree of knowledge in natural sciences), a professional facilitator or a person with professional skills and/or experience in transdisciplinary scientific work and science communication. The facilitator will not only moderate the presentation, he/she will also become the translator of the scientific presentation to move it to lay language. A procedure that has proven very suitable for this is the following:

The scientist and the facilitator will act as a tandem team. The scientist does the presentation. The facilitator will, after each step, repeat the information but in a different "language". This can be done by asking "…have I understood you right?" or other supporting questions. In that way, there is no loss of credibility of the scientific results but at the same time an "easier" translation of the results is provided to the audience. The procedure also assures that not too much is being reduced by an external facilitator or that simplifications are made for wrong aspects.

Before the meeting, it is strongly recommended to meet with the facilitator who has (ideally) been well involved in the prior steps.

2.2.3 Taking advantage of Issue ID and Design Step activities

Not only to reflect the entire process but also to take advantage of all tools used in order to explain the outputs, it is highly recommended to thoroughly go back to the activities of the design step. The following tables will show you the importance of these for the Output Step. The re-use and where appropriate, redevelopment of these social tools, has a number of general advantages.

Building continuity of ideas: Many of these social tools were introduced at the beginning of the SAF process and have been discussed and developed with stakeholders. They can therefore provide a thread of continuity through the SAF process and this has a number of advantages. Building continuity can be used to encourage stakeholders to participate in the output step. The use of concepts and ideas familiar to (or introduced by) the stakeholders in the earlier SAF steps will reinforce their role and ownership within the SAF process and can

also reinforce prior learning. This objective might be particularly important if the opportunities for stakeholder engagement within the preceding stages of the SAF (the Formulation and Appraisal step) have been limited. In such instances it is very useful to consolidate and reconnect with ideas and processes shared with stakeholders in the design step.

Creating better organisation: practical benefits: From a practical perspective, the tools provide a vehicle both for the identification of the range of stakeholders who should be participating in the Output step, as well as building a deeper understanding of their interests and agendas. In addition to helping ensure that the 'right people' are participating in the stakeholder and deliberation activities, another practical benefit come from the fact that increasing knowledge of stakeholders interests and agendas provides the best foundation for the tailoring of presentation materials to fulfil the needs of the audience. Finally, social tools can also be used as a framework for organising the agenda of the stakeholder and deliberation meetings. Mapping of stakeholders and particularly conceptual modelling can provide a useful structure through which to present the simulation modelling and a vehicle for explaining how those aspects that have been able to be modelled interact with the rest of the un-modelled system.

Building more meaningful science: The key premise of the range of social tools presented for use in the SAF process is to facilitate a collaborative and deliberative approach to science and policy integration and promote the recognition of different constructions and viewpoints of the real world. This premise is very important to the Output Step and promotes ideas that can be used to strengthen the usefulness of the SAF approach to real decision-making. Social tools are not always able to be fully included within a simulation modelling approach. Using approaches which enable these social components to be integrated within the process, for example, using the conceptual model for structuring discussions of the model enables many additional aspects e.g. political pressures, management constraints, policy debates, time pressures to be incorporated. This will ensure that the discussions and deliberations undertaken as part of the Output Step are as close to the real world as possible and may increase the likelihood that decisions are taken and that science will be transferred into policy. Utilising tools that maximise stakeholder engagement and deliberation of the issues can also go some way to ensuring the legitimacy of the process and ensuring a fair and equitable approach.

Each of the tools can be considered as separate entities and a short summary of each of the specific tools in term of roles within the output step, and the key advantages of using the tool, can be viewed in the table provided at the end of this document. The following sections focus on the thematic objectives and benefits from using the 'toolbox' as a series of interrelated tools and approaches.

In Annex 1) on pages 72-75 of this document you find the full table of "Taking advantage of Issue Identification and Design Step tools"

Suggested additional reading: McFadden, L. and Priest, S. (2011) Using social tools in the SAF Output Step, Spicosa Project Report, London, Flood Hazard Research Centre, Middlesex University. Available at http://www.coastal-saf.eu/output-step/refs.shtml

2.2.4.Structure, design and extend of the presentation

To maximise the effectiveness of the outputs of the System Approach Framework, it is good to provide your information using a number of formats. This increases the likelihood that the way that the information has been provided will be useful to all members of the audience. There are several things which need to be taken into account when choosing how to present material to an audience. These may include:

- Are your audience politicians, members of the public, academics, etc? This may affect how much, or little information you wish to present.
- Do you want the audience to take the information away, or interpret it with them in a forum?
- How much will it cost?
- How much information do you want to present?
- How complex is the information?
- How many people do you want the information to reach? A small group of managers, or the population of a coastal city?
- Do you need to be able to update the information easily?

There are some general examples of effective ways of presenting data and the suggestions of where these techniques may be used to best effect. Certainly, the various options for presentation formats of the scenario results are strongly dependent on local cultures and traditions of the respective European areas and the scale of implementation. However, each of them should always be backed up by a traditional print out of the information (the Output Package).

You should have three bigger blocks in your presentation:

1) An opening and introduction part where the objectives of the meeting are explained, the process of the prior steps is briefly recapitulated, the usefulness (and limits) of working with scenarios are explained, and a general explanation of uncertainties and assumptions is given.
2) The presentation of the scenarios which includes for each scenario
    a. The description of the policy option on which the scenario is based
    b. The explanation of the assumptions on which the scenario / the different parts of the model are based
    c. Presentation of the modelling results
3) This loop is then to be repeated for the other scenarios to be presented
4) A summarizing comparison of the presented scenarios will then lead to a wrap-up of the presentation.

A recommended sequence to do your presentation is found on page18

Even or especially while working with a variety of different formats, indispensable to follow a clear and consistent structure and to also visualize this structure.
A consistent visualisation within this structure does not mean that you shall not switch between different formats (text, image, animation, etc.). It implies that when switching, you shall pay attention on the coherent use of different visualization options. This can be done by colour coding (for example the economic or ecological dimension), by using the same type of size, shape or colour for the same steps of the explanations (for example for the input, scientific information and interpreted results three different colours or formats), or by using the same diagrams and measurements for the same type of results (such as always bar charts for economic data and always kilograms for weight units). Note that this may seem obvious but plays a crucial role in making all results comparable and easily understandable!
A summary of certain general rules that will help you to prepare these visualisations and use of formats:

- „Pick up“ the audience where they are: this means to use images and visualizations that they are used to, even if this means using a photograph or map such as Google earth or a regional/local standard map.

- Use one general presentation template for the whole presentation and insert all animations, images or texts in this presentation
- use same type of text font, text sizes, background colour throughout the presentation
- When presenting your modelling results / your scenarios, they have to be presented in the exact same sequence and with the same output charts, since otherwise the audience will not be able to compare the results and possible impacts of the policy options
- If you are using a bar chart for your first scenario, it is recommended to visualize your second and third scenario also in bar charts – as well as the comparison between the scenarios
- If you are doing a "live" model run, make sure that the model looks the same for all three scenarios, i.e. use the same visualization option of extend. A recommendable plug in option for Extend can be found here
- If you plan to work with more than one speaker besides the facilitator: make sure that the presentation is prepared in the same template and with the same design and that the different speakers are well informed about the content of each other's presentation
- When explaining and interpreting the different outputs of the social-ecological assessment – you need to ensure that if you use terms more than once they are the same.
- When working with bar charts, histograms or other visualization interfaces, make sure to use the same colours throughout the presentation of the different scenarios. It will facilitate the comparability.
- If using graphs and curves you will need to make sure to use the same definition of the axes throughout the different scenarios
- Avoid slides with long text. The visualization will anyways have to be backed up by the facilitator and the scientist explaining the results. The better the visualization the easier it will be for the presenters to explain the results and to build confidence within the audience.

Once again: the more thorough you focus on this step of your preparation, the easier it will be for the audience (and for you) to compare the scenarios and to be able to compare the outputs and possible impacts, possible futures of the policy options.

In case you would like to show one of the scenarios or even all of them by letting the model run, it is recommended to only once show the "deeper parts", i.e. the graphs and functions of the different model blocks in detail, for example when speaking about uncertainties and assumptions. This is because the objective of holding the forum is to compare the different

outputs and not of making the reference group understand the mathematical processes on which the models are based. E.g. there is most probably no need for presenting the details of a nitrogen block – what counts is to explain well, what nitrogen does or what it does not do. If there are demands for in depth explanation the facilitator will decide on whether this can be done in the forum or in a separate session.

2.2.5 Structure of the presentation

Following the aim of entering a deliberation process after having presented the scenario results, the presentations should be kept short. This implies the following structure as a recommendation:

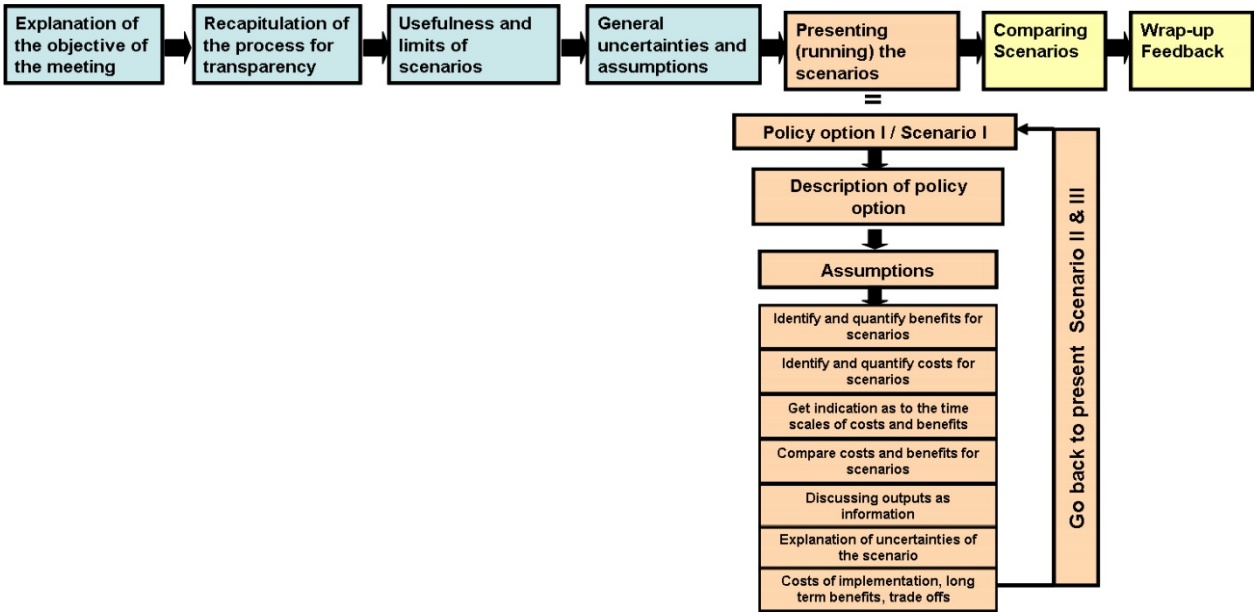

Figure 2) System Output Presentation Structure

- Explanation of the objective of the meeting
- Recapitulation of the process for transparency
- Showing the usefulness (and limits) of scenarios to the stakeholders
- General explanation of uncertainties and assumptions
- Presenting (running) the scenarios for audience
- Explanation of policy options on which the scenarios are based
- Comparing Scenarios

Duration

Your presentation should ideally not be longer than 1 1/2 hours.

A recommended time frame is

- Maximum of 30 minutes for the introduction part including clarifying questions (not discussion)
- Maximum of 20 minutes for each scenario including general questions
- 30 minutes for comparison of scenarios and wrap-up including questions

Remember that the reference group should also receive written documentation of the presentation in form of the output package.

2.2.6 Multi-format use

"*A picture is worth thousand words*" (Fred R. Barnyard)

A good way for structuring your presentation is using multiple formats (ideally the method of multivision, available at http://www.multivision.info/).

Doing your presentation in multiple formats and visualization implies more than just a regular power point presentation and more than just showing graphs and digits to the audience. It is an illustration of what has been done in the modelling process, why it has been done and its use for the target group; a support element for your explanations. Don't confuse this way of presentation with loss of credibility of your scientific results. If done thoughtfully, it will be a good method to do an emotional but at the same time scientific presentation and thus to avoid conflict and people missing out on details.

To present and visualize your results in a multi-format way you will need to structure your presentation into a combination of appealing texts and images / image effects (possibly even sounds) and cooperate with an experienced facilitator.

To visualize well gives you the opportunity to present complex issues in a plausible, clear and demonstrative form. Decomposing complexity can often be an effective vehicle for communicating complex issues. Remember that you will need to make sure that your models and explanations need to be presented self-explanatory on a communication level and not on a scientific level. This implies that by communicating and visualizing well, the results will become understandable for the audience whereas the scientific outputs of the Appraisal Step might not necessarily be understandable to non-scientists.

Visualizing with a thoroughly selected combination of text, images and animations (which can be "extend" or other software interfaces), brings an advantage compared to a one-format presentation (just text, just video or just graphs). It broadens the input of the multiple content-

dimensions and reaches people with different perception habits (for some stakeholders, information is more understandable when presented in texts, for others, this would be images, maps, graphs or animated models). The smart and clear combination is what counts. Besides bringing an engaged or „emotional“ dimension into the scientific presentation, this way of presenting your scenarios will provide a good basis to refer to “the real world”, i.e. to institutional frameworks, to recent political, regional or global events, to impacts for stakeholders, as well as a good basis for feedback and deliberation. It is thus very an adequate option for a transdisciplinary presentation.

Though seemingly common sense: For presenting your scenarios, it might be worth organising a big screen and a high resolution data projector rather than regular ones.

> Keep in mind that this is the last step of the loop – but it should certainly not be the last interaction with your stakeholder group. If the stakeholders remember the presentation of the results as a good and professional event, there will be a higher probability for them to stay in the interactive dialogue and also to spread the information in their surroundings (ideally leading to a higher level of acceptance of decision-making processes in the respective region).

2.2.7 Working with scenarios

„*Scenarios are stories of the future that motivate people to do something*“ (U. Golüke)

It is useful here to reconsider the term scenario:

A scenario is “a coherent, internally consistent and plausible description of a possible future state of the world. A scenario is not a forecast; rather, each scenario is one alternative image of how the future can unfold. A projection may serve as the raw material for a scenario, but scenarios often require additional information (e.g., about baseline conditions). A set of scenarios is often adopted to reflect, as well as possible, the range of uncertainty in projections. (Gilbert, A. et al, 2011)

When meeting with stakeholders the team will make use of scenarios to illustrate the SAF process. A scenario can be considered one of a possible set of descriptions of how the future may develop, based on a coherent set of assumptions regarding key relationships and driving forces. In a SAF, scenarios are developed on the base of numerical models of defined variables of a coastal system, which can be used to simulate how the virtual system may

function with regard to a certain policy or management option. Note that scenarios are neither predictions nor forecasts. During Issue Identification Step a scenario is a narrative account of how a particular management option might be implemented; ultimately, a particular set-up for a numerical model of a CZ system that can be used to simulate how the 'virtual' system will function if the option is implemented. In contrast, a storyline is a narrative, based on a specific set of premises that will define one of possible trajectories of a system, given a specific scenario.

Why do we work with scenarios?
We want to empower policy makers to be able to make decisions more efficiently and in as much coherence as possible with "their" stakeholder's interests. In general, scenarios serve communication processes and sometimes they have the function of a work tool and means for obtaining conclusions in the beginning of an implementation process.

The interaction and deliberation with reference groups is a continuous development during the work with scenarios. The scientists should be aware of the fact that scenarios are used to assess and evaluate the implementation of the SAF and to explore different pathways.
When publishing or presenting scenarios, the illustration has to comply with the demands of the target group; e.g. for fishermen a different language is needed than for regional managers. Explanations need to be expressed in different levels of detail and analytical depths.

Projections or visions of the future have always inspired the thinking of possibilities and provided incentives for creativity. Be it a warning, a visionary desire – scenarios display possible futures and can give orientation for actions.
Scenarios of activities taking place on the coastal zone thus serve as a basis for communication and discussions about the possible futures of the social-ecological dimensions of the respective the coastal zone systems.

The SAF opens the method of scenarios to the stakeholder community
We have learned that scenarios are pluralistic, future-oriented models of the possible future state of coastal zones (though they can also include extreme cases and therefore have the character of an early warning).

With the help of scenarios, a wider stakeholder audience can learn about the decision-making process. Scenarios can let the reference groups reflect possible consequences of management or policy options and open opportunities for action.
The aim of communicating and presenting the scenarios is that stakeholders become aware of the different alternatives for the future as coherent combinations of a great number of variables.

If asked for a long-term simulation:
Stanislaw Lem told us: *"I can tell you what will happen in 200 years but not how the world will function in two or five years"*
When you want to describe tendencies or broad tendencies with a scenario, it is possible to do the simulation for 100 years, thus it will reflect the importance of sustainability for future generations. However, this does not have much use for the contemporary local decision-making processes. It is just about possible for people to imagine the next generation. Long-term scenarios are therefore recommended to be used mainly as a pedagogical support tool: To show how one long-term scenario can be worth as an exercise for visualising and imagining inter-generational responsibility you are referred to the basic principle of the Brundtland Report.

Proof run
Remember that the 'proof run' of specific scenarios should have take place in collaboration with the reference group. Similarly, scenarios can be established through consultation of relevant local documents, such as local development plans. Examples of possible scenarios may include the development of a specific activity, such as aquaculture or tourism, in the form of marina development, for example. These scenarios can be used for illustrative purposes and can actually be based on a real case-study.

2.3 Preparing written documentation: the *Output Package*

Provide the audience and those unable to attend the meetings with written information that they can take home and read up after the meeting. For best quality, agree and produce a clear structure, coherent with your presentation(s) and make sure to also take this structure into consideration when working with images, colors or other options for visualization. This implies to use the same visualization for same types of text, e.g. same font and font size for narrative texts, same colors for social, ecological and economical dimension, same type of boxes for scientific information. Use your creativity to produce information compact (where

possible), credible and understandable. Give short guidelines on how to read the material and seek for feedback and suggestions from your facilitator for improving the Output Package and its appropriateness to the audience.

2.3.1 Preparation of an Output Package

The documentation accompanying the model/scenario presentation will have three main functions:

1) It shall translate the modelling results for the stakeholders for understanding and communication
2) It shall show the usefulness of the results and the process to the reference group
3) Shall provide the reference group with information that they can take home and read up it after the meeting in order to be well prepared for the deliberations

It has again to be clear that the readers of this documentation will consist of a variety of diverging stakeholders, policy makers, managers or local authorities who have different interests, different agendas, time horizons and a common regional history as well as personal relationship structures.

In order to provide the stakeholder and policy making clientele with a documentation which we call ‘output package’, it will be necessary to adapt the scenarios to the reception habits of the respective group / audience and to chose and modify the information to specific formats, as well as giving short guidelines on how to actually read the material.

The output package will follow the general aim of the Output Step and translate structure and reduce the scientific information received from the previous steps and deliver them in an information package for the reference group, which will support the preparation and wrap-up of the science-policy and science-society consultations. The scientific information of the scenarios will be translated into different language codes with regard to the different levels of purpose (Gebrauchswert) of the reference group clientele (levels of interest, decision-making and hierarchy levels).

In the following paragraphs you find recommendations on how to structure your output package. When reading and applying these recommendations, please keep in mind that the output package - the documentation of the process that the reference group went through with you - is the take home information for them and for others who could not join the entire process. It will thus be crucial for the integrated process to thoroughly prepare a standalone piece of work.

Note that the facilitator, who supports the presentations, shall also be consulted; ideally be part of the preparation of the handout documents.

Format of the Output Package

In order to structure and design the Output package, you are strongly recommended to follow the exact same sequences, designs and structure of your presentation in the Stakeholder Forum; as shown in Figure 2 (page 20)

As already started when preparing and holding your presentation, your modelling results will need to be translated into narrative and visual "stories", so that they can be understood by the interested reader independently from participation in the Stakeholder Forum.
It is suggested that for the introduction part you don't spend more than 7 pages.
For describing the scenarios (red boxes), don't spend more than 5 pages per scenario.
Don't spend more than 5 pages for comparing the scenarios (yellow boxes).
These limits already include graphs, images, textboxes and diagrams.
Remember that you will have all the scientific in-depth information at hand after implementing the *Appraisal Step*. You can deliver this information on request at any time.

Coherent magazine format

Be creative when preparing the Output Package. As explained above, the readers will generally lead busy lives, so they need compact, credible and understandable information. Make sure that you are working in the facilitator-scientist tandem again; especially if your facilitator is a professional journalist and has already participated in the *Appraisal Step*.

You are advised to follow these recommendations when preparing your written documentation:

- Work with flow charts to describe each of the sections
    - Make sure that you use them for all the steps, in order to show the overall process. Not just use one flow chart – keep going back to it.
- Use the same visualization for different dimensions and different types of text:
    - Same colours for ecological, economical and social dimensions
    - Same sequence of visualization for each scenario
    - Coherent use of font sizes and font types

- Use a nice and “obvious” mix of formats for different objectives, so that the reader knows the categories throughout the pages (as an example only!):
    - A text box for examples or interpretations
    - Justified text for robust scientific input
    - Left-aligned text for more narrative and holistic texts, texts that make the reader think
    - Images for local recognition value
    - Flow charts to introduce new section
    - Regular text for narrative version of scenario results
    - Colours for dimensions of the model (socio-economical, ecological / ESE)
    - Other visualization options
- When deciding on the different formats, you can categorize for example in theoretical, scientific, practical and illustrative parts or on interpretive vs. objective aspects. What you need to make sure is to follow the same layout and narrative style throughout the whole output package

Never stop referring to the “real” world! If you make the output package look like a scientific paper, it takes dynamics out of the social process that you have started with your stakeholder engagement

It is important that besides the demonstration of the scientific results you include a narrative translation of the different scenarios. Basically you can answer the question: what will a possible future look like if policy option a) b) or c) will be implemented. Chose a year (e.g. 2020 or 2030) and make sure to do it for every scenario to be presented.
Don’t hesitate to even personalize this:
You could go as far as briefly describing a day in the life of a fishermen and an agriculturist in the year 2030. This will bring local identification into the document.
Scientifically sound identification. It will neither patronize the scientist nor the reader. It will be on of the connection points to the real world and writing such paragraph / narrative story of the possible future of a fishermen will be an ambitious and in a way highly challenging task for the scientist-facilitator tandem.
Remember: Entering the Output Step means crossing disciplines for all of us!

Every scientist and/or the relevant facilitator should be aware of the fact that stakeholders come from specific target groups and from different environments. They have their own language and codes, through which they articulate and negotiate their interest within their own groups. The natural scientists need to be aware of this challenge when entering the dialogue / the communication contact with the stakeholders.

It is a semantic work task
The translation into the everyday language of the target groups:
For this, you should informally consult a “translator” of the target group / stakeholder group. You explain the results that come out of the prior steps. You then let the stakeholder explain those results in their own language (Tourism, Fishery etc). This prepares you for the type of language that you will need to use
In the *translation* going deep into the mathematical methods of the modelling process, into the scientific and methodological questions or the mathematical presentations of the results should be avoided.

When translating, it is also strongly recommended to take the perspective of the stakeholders / target groups and implicated consequences for them. What where the consequences that became apparent during the modelling process.
You should also be aware that the different stakeholders will have different cultural interpretive frameworks (you will also find this as an ethic rule about traditional ecological knowledge). What seems important to the modeller (scientist) in the context of the scenarios does not necessarily need to be of importance to the stakeholders. Consequently you need to think and do your translations with regard to the values and norms of the different target groups.

How can this be done?
Good practices have shown that it is useful to translate scenarios into the daily life and daily cultural situations of the stakeholders.

> For example into the experiences that a fisherman or a regional manager would experience in the year 2025 during a day or a week. This will show how a possible future could be and because of their precise conclusions, the presented scenarios are making the options for the future open for subjective assessment and thus open for discussion and deliberation.

Finally, this approach allows a holistic and narrative presentation – you might want to see this as or even use an *intuitive* consistency analysis to obtain an early warning for inconsistencies and to therefore avoid wrong decisions.
What fits into the stakeholder's realm of experiences and expectations and what doesn't? What might be missing and what should be emphasized more? This means that in the dialogue with the stakeholders, they will quickly be able to approve or disapprove if the presented scenario reflects the real world. Such descriptive (normative) scenarios therefore also have the advantage that they point out values and attitudes of the stakeholders and make those open for discussion and deliberation.

As already mentioned, it is advisable if scenarios are modified according to the target group, as we will get closer to their interests and language.
It has become clear that one of the biggest barriers between the outputs of our models and use of these outputs is how we provide the results to the audience. To a large section of the population numerical figures and the graphs are not obvious ways of reading information but often intuitively comprehensible. Much more useful is to use categorization and description of outputs is such a way that they are relevant to the audience.

What to do with the Output Package?
The output package should be made available before the Stakeholder Forum. It should be delivered in digital and printed version and made available also after the meeting upon request and to those unable to attend.

2.4 Organise meeting

Meet with a test audience, or as you may call it a peer-group. Introduce them to the SAF process and present your prepared presentation to them, as if they were the "real" audience. Improve your presentation based on their feedback. Note that this exercise has shown beneficial in similar applications in order to identify pitfalls of your presentation and to improve parts not obvious to the presenter. Your test audience can be anyone from family member to work colleague.
For the organization of the meeting, follow the guidelines implemented in the Issue Id step, adjusting these to the present situation of your application.

2.4.1 Meet with a peer group

A first round of the presentation should be done with a peer group. It is in this case possible that the peers are opinion leaders. However, at this step it is important, to minimize possible errors. This test-round will need to be organised prior to the stakeholder forum and the peers will need to be invited, i.e. the peers will need to take some of their time to come and an invitation thus needs to go along with an incentive to take part.

Suggested reading for organising and convening such meeting: Vanderlinden, J-P., Stojanovic, T., Schmuëli, D., Bremer, S., Kostrzewa, C. and McFadden, L. (with others) (2011) The SPICOSA Stakeholder-Policy Mapping Users' Manual, Spicosa Project Report, Guyancourt: Paris, Université de Versailles-Saint-Quentin-en-Yvelines. Available at http://www.coastal-saf.eu/design-step/refs.shtml

3. Stakeholder Forum

3.1.Introduction

Explain the objective of your meeting and recapitulate the process of your application for transparency – make sure to keep referring to the prior four steps and to qualitative dimensions of the engagement process. Make sure to take advantage of the Issue id and Design Step activities and tools provided to demonstrate and illustrate changes and the process. Show the usefulness and limits of scenarios to the audience and evaluate the process as you go along (in the forum). Never stop referring to the "real" world. Show the impacts and implications for themselves to the Stakeholders at any time. Extrapolation from the model results to implications in the real systems should be explicitly highlighted.

3.1.1 Stakeholder Forum

You are depending on the reference group being interested in you and in what you are presenting. It is therefore crucial that you show an honest interest in them and in their stakes. Of course this has been an important aspect throughout the prior steps also. If the audience consists of a variety of different stakeholders (farmers, fishermen, environmental managers, local and regional politicians,…), it is crucial to communicate on a meta-level so that everybody receives 'sufficient' information. Also, it will be important to define a (more or less) common regional interest (e.g. funding opportunities for the whole region).If the group is too diverse or tending towards conflict, it is recommended that an initial meeting be held for each respective group before bringing the groups together to present the scenarios in the above mentioned meta-level.

3.1.2 Entering the real world: Conduct the Stakeholder Forum

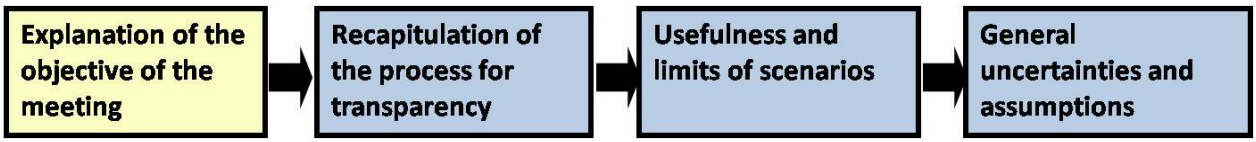

Figure 3) System Output introduction sequence I

3.1.3 Recapitulation of the entire SAF process for transparency

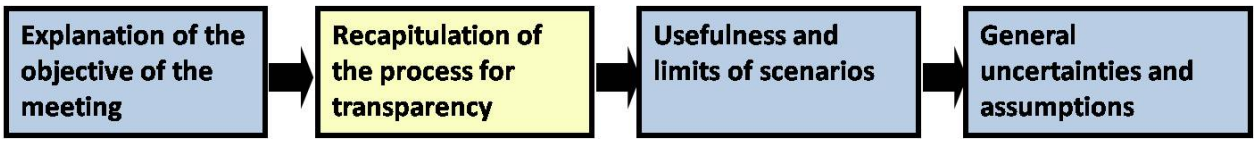

Figure 4) System Output introduction sequence II

You will need to briefly explain to the stakeholder and reference group audience what has been done so far.

Ideally you have chosen a policy issue in the beginning together with your stakeholders and then defined different policy/management options in order to build scenarios in the models and after consultation with stakeholders selected those which shall be presented to the stakeholder forum in this present step of the process. The scientist should not have been the person to select which scenarios are to be presented.

Prior to starting the presentation of the scenarios, the initial and general recapitulation will be an essential starting point in the Stakeholder Forum to build confidence and transparency:

You enter this step of the systems approach framework with:

- The system based model comprising social, economic and environmental component which have been developed by you and your reference group in the Issue ID and Design Step
- This model has been calibrated and validated
- You have determined numeric measures of error in the model
- You have developed scenarios which can be applied to the model to give indications of possible future states of the system.

Where/when has the reference group been involved?

You should highlight the steps in which the reference group members have given feedback and information. As said before – it is at this stage very important to explain the entire process. When presenting the model, it is important to inform the audience about which stakeholders have given input and feedback at which step of the process and where the quality of the model could be improved as a result of the information given by the reference group

members. It has to be made clear that the stakeholder's involvement has been of added value for the scientists and that without these inputs and feedbacks the scientist would not have been able to produce the model FOR the reference group.

Taking advantage of Issue Id and Design Step Activities

Again it is now important to thoroughly go back to what has been done in the Issue ID and Design Step activities.

To read the full article of using social tools in the Output please go to www.coastal-saf.eu/output-step/refs.shtml

To go back to the brief overview of social tools in the Output Step, please move back to page 15

3.1.4 Show the usefulness (and limits) of scenarios to the audience

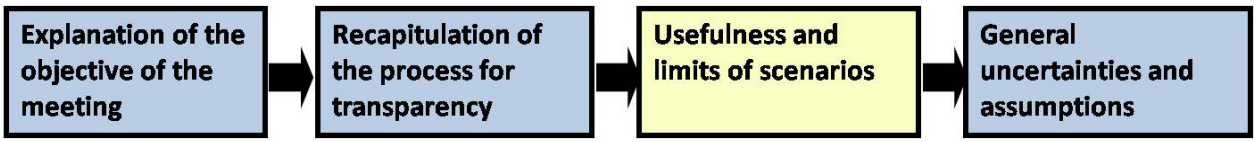

Figure 5) System Output introduction sequence III

The target group specific presentations must strongly show the usefulness of the scenarios (and the communication with the science policy interface) for the stakeholders and policy makers and the usefulness of using scenarios for their decision-making and the implementation of these decisions.

If this is not taken into consideration, it is most likely reference group will lose their interest in scenarios.

3.2 Scenario presentation (1,2,3)

Present and translate the interpretation of the ecological, economic and social modelling results to the audience:

Give a general explanation of uncertainties and assumptions and the present the different scenarios to the audience by following the same sequence of explanation for each. A recommended sequence is as follows:

- *Explain the policy option*
- *Identify scenario inputs and outputs*
- *Explain assumptions*

- *Identify and quantify benefits for scenarios*
- *Identify and quantify costs of scenarios*
- *Get indication as to the time scales of costs and benefits*
- *Explain uncertainties of the scenario*
- *Explain error envelopes of the models*
- *Explain possible unexpected changes*
- *Run an additional scenario if requested by the audience*

3.2.1 Interpret and present the social-ecological modelling results to the audience

When presenting the modelling results to the audience you need to be aware of the following aspects: Every scientist and/or the relevant facilitator should be aware of the fact that reference group members come from specific stakeholder groups and from different environments. They have their own language and binary codes, through which they articulate and negotiate their interest within their own groups. The scientists need to be aware of this challenge when entering the dialogue with the reference group. Stakeholders only listen and translate within these 'codes' and if they hear something different, it will be sorted and 'removed' (Luhmann). On the other hand, most stakeholders have multiple stakes, e.g. as fishers, parents, hikers etc. The presentation should therefore use examples that bring the different coastal spheres together. One therefore has to be aware that it is essential and inevitable that the modelling results, the scientific results are reduced, especially if the objective is that audience understands the presentation well.

3.2.2 General explanation of uncertainties and assumptions

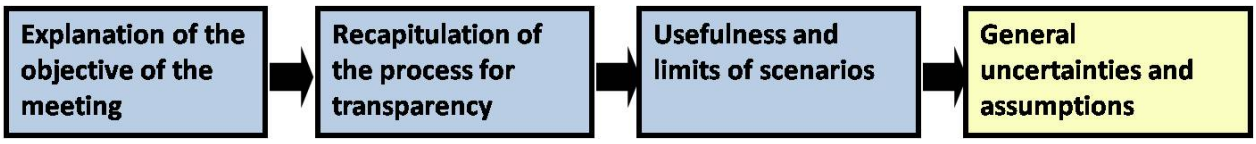

Figure 6) System Output introduction sequence IV

Scientists frequently stress all the conditions, uncertainties etc so strongly that lay persons can get the impression that nothing can really be concluded, thus reservations that are normal for scientific presentations can cloud the message for the non-scientist. This can be confusing and valid conclusions should be made clear. However, it is also very important to explain that the models are based on assumptions and that our present knowledge will limit the predictive

power of the models and/or impose some levels of uncertainty or confidence borders on the predictions. This difficult balance between making the limitations of the predictive value of the model tool clear to audience on one side and demonstrate the usefulness of the tool on the other side is very important for the presentation. It is important to make sure that the audience realises that current knowledge sets limitations on how precise a model can be and that using modelling softwares always will impose simplifications. But also make sure that once this context is made clear that all following conclusions are stated as valid within that context. A good way to gain credibility is to demonstrate how the model portrays existing conditions which can be recognised by the audience. It has to be made clear to the audience that scenarios are by no means a certain or an accurate prediction of the future. Their objective is in fact to present possible future conditions in such a way that the same audience is able to imagine these conditions, to find subjective interrelations and connotations, thus create a basis for discussion and deliberation. They are about gaining own imaginations and desires with regard to the described futures – depending on whether the presented scenarios and their details seem desirable, ambivalent or even frightening.

Also, it has to be made clear that none of the scenarios will need to be accepted completely. Some people in the audience may favour it and identify themselves with a certain person or attitude – or not. Keep in mind that such possible constraints or hidden pitfalls can support scenarios and the discussion about them and about action options and possibilities for implementation and formation. They are a tool for empowerment towards a proactive and framing perception of the future and the transition to the deliberation process that follows the presentation of the scenarios.

A significant characteristic of scenarios is that they allow a positive look into the future. The desirable chances and benefits can be put in front without letting the scenarios become ‘utopia’ and without fading out disadvantages, risks or problems – they should be faced, not removed. No utopia shall mean that scenarios are linked to existing social contexts, to trends and to developments of the region or community. They can as well be hooked to technology and innovations which are considered as possible or feasible for group members.

Speaking about trends implies that the logical time scale for the presented scenario is a medium time horizon: ten up to a very maximum of twenty years.

When constructively and critically dealing with the scenarios, the audience could ask the following questions during the presentation of the scenarios:

- How desirable do the presented developments and conditions seem?

- Which aspects should be different and which ones need to be added in order to make the overall results more coherent?
- Would it be possible to promote those scenario elements which seem desirable to 'me' and to avoid those that don't seem desirable?

Uncertainty in ecological models

Uncertainty is present at all stages of the assessment process, whether it be uncertainty about the magnitude of physical impacts and their geographical and temporal distribution or uncertainty over the value of changes in ecosystem goods and services. Whatever methodology is used to conduct the assessment, all results should have been subjected to a rigorous sensitivity analysis. Sensitivity analysis allows this uncertainty to be explored in a constructive manner and can be used to identify the parameters of the system which are particularly subject to uncertainty and that have a significant impact on the overall outcome of the assessment.

Degradation and loss of ecosystems, and subsequent loss of their associated services, constitute a reduction in natural capital. Whether or not this implies an unsustainable path depends on the extent to which one believes that the ecosystem services provided by natural capital can be substituted for by other forms of capital. Whatever the case there is a great deal of uncertainty about both the consequences of ecosystem service degradation and loss, and the ability to generate substitutes. Given this uncertainty, and the potential for catastrophic change, many would argue for a precautionary approach, in which case current rates of biodiversity and other natural capital depletion are a source of serious concern for sustained maintenance of human welfare.

Ideally ecosystems would be managed with sustainable development in mind. In practice, there are a number of acknowledged reasons why ecosystem degradation continues unabated. These reasons mainly include market failure and poor governance. One of the key causes of market failure is lack of information, and so the provision of information on the economic value of ecosystems can under circumstances contribute to better decision-making. This current lack of knowledge relates both to ecosystem functions and economic values. Poor knowledge of the mechanisms by which bio diverse ecosystems are maintained is a barrier to the development of effective management and assessment protocols.

Risk can be seen as the likelihood of occurrence of a set of factors leading to an undesirable outcome. In this context risk can be seen as a combination of the probability of a hazard

occurring and the probability of the system being vulnerable to that hazard, which would then result in a negative outcome. Uncertainty, in general terms, is the lack of confidence in the likelihood of future events occurring and it is in a way more difficult to quantify. This uncertainty may arise from different aspects and steps in the process.

In terms of modelling, it is clear that different levels of complexity can be considered. First we do not have an absolute understanding or knowledge of the full workings and functioning of reality. That level of knowledge is not a requirement for the construction of a good working model. In fact simplicity tends to be a more desirable way to progress when modelling, given our ability to comprehend and assimilate simpler structures and processes. However, would the adopted ‘simple’ model be appropriate to represent ‘reality’? It is important to realize that models are often used to represent the physical system as well as our understanding of the science and theory linking the different compartments and defining the links. Will our knowledge and representation of ‘this science’ be appropriate? Another possible source of uncertainty relates to the parameters needed in the modelling process. How much knowledge do we have about them and can we improve this knowledge via some kind of predictive relationship? This would reduce uncertainty. For example, we may find (possibly via sensitivity analysis) that a model is very sensitive to a key parameter. This parameter may be difficult to measure, or else in order to improve the model, we may decide that it would actually be better if we could predict this parameter by devising a (mathematical) relationship with another parameter we can actually reliably measure. However, how reliable is this relationship and how can it be improved?

Therefore when modelling natural systems it is always better to start with the simplest conceptualizations and mathematical representation given these systems’ complexity. Models can then be made more complex following a stepwise approach, by changing assumptions and representations if and as these prove unable to simulate realistic behaviour of the target system. In this context 'realistic' is defined in terms of ability to simulate the correct qualitative behaviour of the system as it changes in time under natural forcing or in response to a perturbation, and to generate values of the state variables that are within observed envelopes of variation. This is an iterative learning process that would lead to an improved representation of the system and therefore would improve our understanding of the system functioning. Following this process would result in reduced uncertainty which would increase our confidence in the model and in its outcome.

The design of the model, as well as the assessment of its suitability to the task in hand, including the undertaking of sensitivity analysis, is the responsibility of the scientists. During

the presentation it can be made clear to stakeholders what the sources of uncertainty may be and what was done to address them during the process. When presenting the model to the stakeholders it is most likely and indeed desirable that an interactive process takes place. Stakeholders may provide inputs and suggestions that may lead to changes in the modelling approach. The processes previously followed to reduce uncertainty (described above) may need to take place again (not in the presence of the stakeholders, although a simple explanation should be provided). When running sensitivity analysis there are standard procedures that should be followed, however it would be important to involve stakeholders in decisions such as which parameters they may think are important and in which they may interested in assessing any overall impacts resulting from any alterations in these parameters by a pre-defined percent. This would allow the reference group to evaluate model sensitivity to specific parameters and as such improve their understanding of uncertainty.

3.2.3 Presenting (running) the scenarios for audience

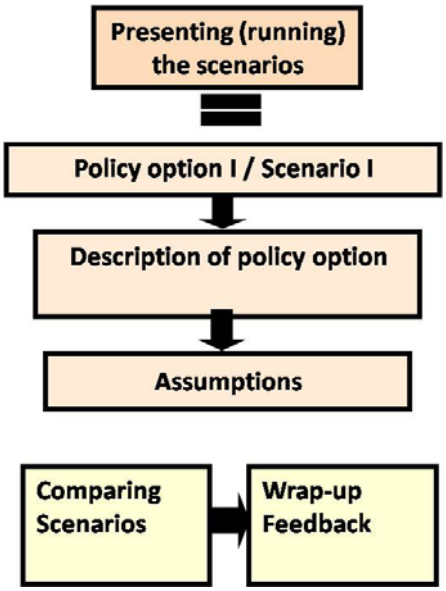

Figure 7) Sequence scenario presentation

You now take the scenarios you have developed, apply them to the model, and examine the outputs of a model. You interpreted these outputs in such a way that they can be provided to stakeholders and policy makers and be considered useful by this audience.

Make sure that you present the different scenarios with the same sequences and visualizations (for comparability) as explained. Point out those aspects that are changing considerably from one scenario to another.

Before presenting your findings to a forum audience, you must prepare your information in such a way that you can explain the advantages of the model and its outputs that you have produced. But equally you must provide information on the possible negative outputs of the scenarios. You need to be careful to provide a balanced view of what the results of your scenarios show. The following steps provide a procedure that will make your presentation easier.

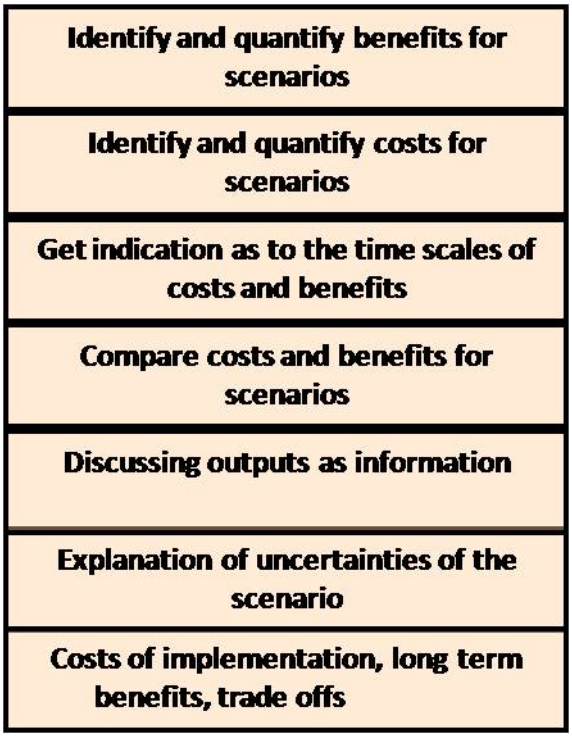

Figure 8) Presentation sequence for each scenario

How to present model findings to an audience

When we consider showing the findings of our models to an audience, we need to think about what it is we will be showing them. Numbers in themselves are difficult to interpret quickly and accurately, which is why we tend to use graphs and figures to present findings in publications. However, what numbers should we be reporting on?

Run models with pre defined scenarios in front of audience. Use graphical output of the model to visualise what is happening.

Use running averages to smooth variability from seasonality, if running on a monthly time step, and 12 point running average will remove annual seasonal variability.

A simple end point is often not useful, instead we need to design a way of showing what has happened during the period that the model has run. Where a simple change over time is not evident, taking a running average and reporting a how that changes may be useful. The

simplest measure to be used is the rate of change of that variable (1st differential), which in the case that a curve is not described mathematically can be represented by the gradient of the change in that variable over time.

Identify scenario inputs and outputs

Each of the scenarios that are run on the models will have input parameters which deviate from each other. These will be important to emphasise to the forum as there will frequently be the costs or savings that are the responsibility of the audience. Equally you should identify the main output variables and emphasise the importance of these, referring back to discussions from the Design Step.

Read more about alternative policy instruments on www.coastal-saf.eu/output-step/refs.shtml

Assumptions

As part of the process of designing and constructing your models, you had to make certain assumptions on how the system functioned. As these assumptions could greatly affect the outputs of your models, it is important to communicate these to your audience, including the extent to which these assumptions will affect the output of the model.

a) Identify and quantify benefits for scenarios

These will be the positive aspects of your scenarios, which the audience can discuss to support the adoption of a particular course of action. The problem with these benefits is that usually only parts of them are direct economic benefits that are already valued by market prices. In most cases you will have to make clear that a considerable share of benefits consist of indirect economic effects or ecological and social benefits that are not valued in monetary terms in the first place. It is a methodologically difficult and politically often challenging process to find adequate dimensions to measure and communicate the multidimensional benefits of management options. Therefore valuation methodologies must be explained clearly and transparently.

To acknowledge the standard perspective on benefits the presentation of financial benefits may be a good starting point for the discussion. But since usually at least some if not a considerable share of benefits associated with environmental policy concern public goods that have no direct market value, do not raise the expectation that financial benefits will be the job to outweigh the costs of implementation easily. It is often the case that direct financial

benefits are modest compared to the costs of policy measure implementation. So broaden the picture step by step to show the parts of the valuation that are often neglected. Namely the indirect financial effects, if you take into account also regional or national economic effects and positive side-effects on complementary activities.

The field of environmental benefits is somewhat more complicated. As mentioned above, you have to make very clear, which methods to assess non-market values your team has employed. If you have expressed the values in monetary terms, they will be easily comparable with the financial benefits (and costs). But also in this case you should discuss the assumptions of the method, its limitations and include a sensitivity analysis or other means to deal with the uncertainties embodied in the method. If you did not monetise the environmental benefits, you have to discuss the weighting of the different dimensions of benefits in course of a cost-effectiveness or multi-criteria-analysis – to make sure, that non-financial benefits are not neglected or are ranked lower than already monetised costs and benefits just because they show no monetary value at first sight.

Social benefits can comprise some of the indirect financial benefits mentioned above, so beware here of double counting. The aspect to be discussed here in detail is mainly the distribution of benefits within or among the affected communities – be it a local, regional, national or global community. The main question here is: Who will benefit and who will not? This question is often neglected and accordingly leads to unexpected problems in practical political processes. Especially drawn together with the question of who will pay for the measures, it can explain consent or opposition by positively or negatively affected stakeholder groups. This might also be the case if the policy leads to a theoretically overall “efficient” outcome in allocative terms. The distributional aspects should in any case be analyzed and discussed thoroughly. Many of these social aspects can be assessed by an actor or stakeholder analysis that could be presented in this context to more comprehensively cover the social dimensions of the investigated effects.

b) Identify and quantify costs for scenarios

To present how scenarios will affect the system we must evaluate the costs that these changes will incur. These will be considered the negative qualities of the scenarios, be they financial (e.g. costs through loss of amenity), social (e.g. loss of jobs, thus well-being) or ecological (e.g. habitat loss). The costs can occur as “costs of doing nothing” – so they may be higher, if no environmental policy measures are implemented. But often the implementation itself causes costs of considerable amounts, since it requires investments or implies restraints to current ecosystem uses.

The most directly visible costs of policy measures are the financial costs – most easily displayed as investment and maintenance costs. But also costs of non-usage or restrictions to current uses should be calculated and discussed. These indirect costs also cause financial losses, which are more difficult to detect, but will result in political opposition by stakeholders negatively affected. Therefore also these indirect costs should be analysed and discussed as far as possible.

Closely connected with the indirect financial costs may be the social costs of a policy option. Here – similarly to the benefits discussed above – also the distribution of the costs should be discussed carefully. Since the incidence of costs and benefits may often not match in the sense that the cost bearing stakeholder groups might be very different from the beneficiaries, compensatory policy options should be discussed in that context. Also concerning the cost, an actor network analysis can reveal social conflict potential and show decision makers possible paths to socially responsible and consensual management options.

Environmental costs occur mainly in the case of ‘doing nothing’ compared to additional environmental management options. So here is a close correspondence with the environmental benefits of ‘doing something’. But also the possibility that doing some good to one environmental dimension might do harm to another should be discussed (e.g. CO2-saving offshore wind parks vs. submarine noise emissions). Finally, environmental costs are of course present if investment projects intended to raise profit or regional economic product are to be assessed by environmental impact analysis or cost benefit analysis. Here the same methodological problems as with the environmental benefits occur and have to be discussed transparently. The environmental costs are difficult to value and therefore it has to be made sure in the decision making process, that this does not lead to ignorance towards environmental costs.

c) Present and discuss the time scales of costs and benefits

A major barrier to the acceptability of a scenario will be where a short term cost will lead to a long term gain. Running scenarios in your simulation models will be able to provide an approximate time frame in which the change in human activities, or capital input will have an effect on the system. Naturally stakeholders who put resources or effort into a management scenario will wish to see the fastest possible result of this input. The uncertain potential of a positive system response at some unspecified point in future might not be a convincing incentive to follow this course of action.

Running the simulation model and tabulating results which show when impacts could reach their target values might be an effective tool to make time scales transparent. Similarly showing the audience the running of the simulation model with and without certain inputs could be an effective way of demonstrating the importance of each group's actions.
But there will be no way around a discussion of time preferences. The results of a cost benefit analysis are highly depended on the discount rates implied. A short-sighted time preference (high discount rate) will weight short term cost higher than long term benefits. A time preference taking into account also the interests of future generations would put more weight on the long term benefits – the current investment costs thereby loose much of their prominence. To make the consequences of different time preference assumptions transparent, results of cost benefit analyses should be presented accomplished by a sensitivity analysis concerning the implied discount rates (e.g. ranking between close to zero up to 5 percent). It might also be useful to provide time dependent curves that show the development of costs and benefits over time. This way of presenting the effects of different time preferences could be made palpable and thereby more easily discussable.

d) Compare costs and benefits for scenarios

As discussed above, costs and benefits should be presented in tables and/or diagrams. The final results of a cost benefit analysis can be presented in absolute terms over a certain planning period, in discounted present or annual values or in benefit-cost ratios. The choice of the presentation format is dependent on the problem perspective of your audience and should be chosen accordingly.
To reveal the uncertainties and assumed time preferences, the range of uncertainty and the effects of different discount rates should be presented in additional charts or should be included right from the beginning. But you have to be careful not to overload single tables or diagrams with over-complexity. Otherwise disorientation or rejection by the audience will be likely.
Often a fundamental opposition to valuation of environmental or other non-market goods or services is prevalent in the audience. And of course a fully monetised cost benefit analysis is not the only possibility to value and weight non-marketed and intangible ecosystem services. So to avoid a rejection of your research results just because of the valuation method employed and to draw a broader picture of possible valuation approaches, you could additionally or alternatively present a multi-criteria analysis. This method does not try to melt everything into one dimension (i.e. money). It shows the effects of baseline developments and management

scenarios on the multiple dimensions of the ecological, economic and social systems. The problem with this method lies in the complexity of its results. It is know from psychological experiments that it is difficult to make judgements on different alternatives taking into account more than seven criteria at once. But a multi-criteria analysis can easily supply dozens or hundreds of criteria. Without aggregation and/or weighting with the help of indicators, decision makers and stakeholders will be overstrained and disoriented. On the other hand, aggregation and weighting in itself is a difficult process relying heavily on strong and influential assumptions and value judgements. So, multi-criteria analysis also has its methodological problems that should be revealed and discussed openly.
A special and widely used case of multi-criteria analyses is cost-effectiveness analysis. It takes monetary values on the cost side and confronts them with non-monetary values on the benefit side. It can be used to discuss how to reach a certain environmental target as cheaply as possible or how to reach a level of environmental improvements with a fixed budget. The difference with a full-blown multi-criteria analysis lies in the reduction of the dimensions judged relevant to usually only one or two. In the presentation of a cost-effectiveness analysis, it must be made clear that this means ignorance towards all the other (possibly also relevant) dimensions of effects. The results should therefore be discussed posing the question in how far other relevant economic, environmental and social dimensions would be affected.

e) Discussing outputs as information

Data do not become information until it has been interpreted. We have looked at how we could change numbers to symbols to clarify changes in variable in our models. But how do we discuss these outputs in the context of the system we are studying, and how will we know if the management strategy we are developing will be a success? An effective way to do this can be through the use of examples and reference points.

- Changes in your indicators that refer back to the Issue ID and Design Step. An important piece of information for policy makers and managers will be whether or not the scenarios suggested will result in an improvement of the indicators greater than that set out in the objectives. If this is the case then the management strategy can be considered a success.
    - Changes to improve beyond, or deteriorate past levels set out in legislation. Changes in indicators past these levels may well influence other variables in a way that is easy to envisage and discuss. For example if beach water bacterial counts fall below the EU guideline values then it is easy to imagine that there

will be an increased number of tourists willing to come to that beach resulting in more money, and potentially jobs, becoming available to the local community.

  - Variables at above or below historical events
- A more pristine state
- A historic severely deteriorated state that falls within the living memory of the audience.

The next pages describe the use of economic tools in the output step. To skip these sections and continue with the explanation of uncertainties of the scenario, please move to page 47

(A) How to best present results of Cost Benefit Analysis to stakeholders?

Cost benefit analysis results are probably best presented to stakeholders on two levels. A simple overview of the main results on one or two sides of A4 paper – or a as part of a 15 minute presentation – with the detail of the analysis and results presented in more detail in a technical report. CBA results can usually be presented in terms of a few headline indicators, however all results should be presented within the context of a comprehensive sensitivity analysis (that should be detailed in the technical report) and any uncertainties surrounding the results should be highlighted. A sensitivity analysis concerning the implied discount rates (e.g. ranking between close to zero up to 5 percent) and the presentation of time dependent curves that show the development of costs and benefits over time will shed light on the effects of different time preferences. Where costs or benefits are difficult to value and hence cannot be included in the 4
"bottom-line" figures it is very important that these omissions are underlined and their possible implications discussed.
Note that one of the reasons for the prevalence of CBA in government economic evaluations is because it can provide a single monetary figure upon which decisions can be made. This single figure has the benefit of simplicity, but can hide a multiplicity of uncertainty, simplifications and assumptions – it is your task to bring these out into the open and make them obvious to stakeholders.

(B) How to best present results of Ecosysem Services Valuation to stakeholders?

Ecosystem services valuation techniques help provide monetary figures to stakeholders. Bear in mind that these figures are a translation of human preferences (i.e. welfare) and do not represent money that can be touched upon. Whether these figures are presented within the

frame of cost benefit analysis or not, these methods have the benefit of simplicity. However, they are most of the time simplifying reality, hiding uncertainties and resting on strong assumptions. Results often suffer from many biases inherent to survey data collection methods or to the theoretical grounds on which these methods are built. It is important to underline all these limitations while presenting your assessment to stakeholders. Explain thus clearly what your results cover, what they do not cover and discuss possible implications. A qualitative description of the changes in ecosystem services that have not been/could not be valued should accompany the analysis. Encourage stakeholders to use these results with caution, it is important not to give them a distorted view of the impacts of the studied issue/scenario on human well-being.

(C) How to best present results of Financial Analysis to Stakeholders?

The results of a financial analysis should be presented and interpreted carefully. Advice should also be given to stakeholders to be cautious with respect to the use of the results. While presenting the results to stakeholders, bear thus in mind the main limitation of the method: the economic figures you obtain relate to private interests and as such do not represent the whole economic impact of the studied activity in the region. Neither do they cover other impacts: environmental, social or cultural.

An estimation of the number of jobs in the activity alongside the results on the cost structure, revenues and profit can help highlight another aspect of the analysis.

(D) How to best present results of Input-Output Analysis to Stakeholders?

The results of an economic impact assessment should be presented and interpreted carefully. Advice should also be given to stakeholders to be cautious with respect to the use of the results. 3

While presenting the results to stakeholders, bear thus in mind the limitations of the method:

- Such an economic assessment only pertains to regional economic impacts and not to all the impacts of the studied activity (environmental, social or cultural).
- Income or value added are certainly the best measures of economic impact to report, compared to employment impacts. In the tourism sector, for instance, job impacts might be misleading because jobs in this sector are largely part-time and seasonal. Wages and salary rates vary as well across industries and this can make the multipliers vary accordingly.

- Working with Input-Output multipliers literally multiplies up the uncertainties regarding each step of the method: small errors in terms of estimation of the direct impact (expenses or output), of regionalization of the Input-Output matrix and of multipliers are added up and contribute to the uncertainty in the final results.

Some hints to answer those limitations:

- Even though it cannot be clearly measured, presenting the results in terms of ranges of values (rough confidence intervals) rather than a single figure can help to underline the inherent uncertainty of an economic impact analysis. A sensitivity analysis can also help.
- It might also be interesting to first present the direct effects in terms of spending or change in final demand (supposedly highlighted in the simulation model) and the multipliers; to then show the broader impact (including the indirect and induced effects) while explaining the differences and underlying uncertainties with respect to each step of the method. This will help shed light on the importance of broadening the perspective, away from considering the simple direct impacts of one measure. At the same time, it will provide a good picture of the assessment.

To conclude, bear in mind, at all times, the assumptions and limitations of Input-Output methodology while analyzing and using the results, do not oversimplify or misinterpret the results, use them with caution, since it might leave the stakeholders with a sometimes distorted or incomplete understanding of economic effects.

(E) How to best present results of Multi-Criteria Analysis to Stakeholders?

The results of a multi-criteria analysis should be presented and interpreted carefully. Advice should also be given to stakeholders to be cautious with respect to the use of the results.

While presenting the results to stakeholders, bear thus in mind the limitations of the method:

- The performance matrix representing the scoring of many different options on many different criteria might be very complex.
- The process of weighting comprises sensitive value judgments.
- The process of ranking non-dominated alternatives might influence the outcome.
- Therefore it might be difficult and time-consuming to come to a common view on the performance matrix and to identify consensual decision options in one exercise.
- If weighting and ranking procedures remain controversial, it might be impossible to reach an agreement on optimal decisions.

Some approaches to answer those limitations:

- The choice of relevant criteria, scoring scales, weighting and ranking procedures should be presented and discussed very transparently.
- If there is disagreement with one of the steps of the multi-criteria analysis, the step in question should be reformulated in a consensual way and the consequences of this reformulation should be analysed. This could be prepared in advance in the course of a sensitivity analysis – especially if potentially sensitive aspects prone to conflicting views are identified in advance.
- Pre-tests with focus groups can help to identify criteria seen as relevant and to discuss different weighting options towards these criteria. This can also be prepared or supported with surveys via interviews or online questionnaires.

Multi-criteria analysis results can be compared with cost effectiveness or cost benefit analysis outcomes to show the differences and congruencies between the different approaches. This can help to move stakeholders and practitioners out of potential perceptions biases they bring with them into the discussion or workshop situation. Such a comparison can also help to show (or question) the robustness of the different assessment approaches.

Read the full versions of the economic specification sheets at www.coastal-saf.eu/design-step/refs.shtml

A full version of the Economic Specification Sheets for the SAF is available at http://www.coastal-saf.eu/design-step/refs.shtml

3.2.4 Explanation of uncertainties of the scenario

To effectively describe the outputs of a model to an audience, you must describe not only those outcomes, but also the uncertainties associated with them. It is important that for each scenario the uncertainties and assumptions are explained and that it is visible what impact they have on the predictive capability of the model and the possible futures if a policy option is implemented. Make sure that you explain in general terms the limitations of your model and that you show that even with the limitations you are able to simulate the actual state of the coastal area in question as a calibrated and validated model. Make also clear that model runs and the predictions given as scenarios will be presented as ranges rather than as exact numbers. It is very possible that the audience will ask for the probabilities, i.e. when presenting the scenarios, you will need to be very well prepared to answer spontaneous questions on uncertainties and assumptions, besides those information that you have given to them when presenting the scenarios.

Error envelopes of models

Similar to the assumptions which were made while constructing the models the errors associated with the running the models need to be carefully explained to the audience. These errors may not be intuitively obvious to your audience and they may assume that errors are not important. The Appraisal Step is largely concerned with the identification and minimisation of error in models, and therefore worthy of discussion with the stakeholders when reporting back to them. We should, at the very least, give an indication of the effect the error envelops could have on our results. An effective way of doing this is by the use of error densities on a graph which shows your prediction (a fan chart); the modelling error, which was calculated during the Appraisal Step can be applied to each time step of your modelled projection and included in a graph.

Unexpected changes

As well as the assumptions and likely errors, we must also make clear that things may happen which are simply beyond our capacity to predict, and that these changes may fundamentally change what happens to the system being modelled, far outside the range of the errors discussed above. These can take place in any of our social, economic or environmental components, for example:

- Recession, an economic factor – changing patterns of money flow on both a macro and individual level. Recession, as see in the 2008 ‘credit crunch’ resulted in a reduced willingness to pay for more expensive luxury items, including more expensive species (which help to support fishing communities), or tourism attractions, (a major source of income in many coastal areas).
- Environmental regime shift, an environmental factor – for example the North Sea regime shift, which was a result in a change in the flow of water entering the North Sea from the North East Atlantic. This resulted in a shifting of species distributions, both spatially and temporally, and population sizes beyond those seen in recorded data, and therefore would not be predicted by models.
- War, a social factor – given that the scenarios rely on a change of a system's management in an ordered structure, the breakdown of the structure is likely to take place in a conflict. A more peaceful example which could bring about a change in social direction could be a change of government in a country. This could change the emphasis of political will towards or away from environmental protection.

- These shifts are generally so massive that it is easy to convey to your audience that they will invalidate the outputs of your model.

3.2.5 Uncertainty in ecological models

Uncertainty is present at all stages of the assessment process, whether it be uncertainty about the magnitude of physical impacts and their geographical and temporal distribution or uncertainty over the value of changes in ecosystem goods and services. Whatever methodology is used to conduct the assessment, all results should have been subjected to a rigorous sensitivity analysis. Sensitivity analysis allows this uncertainty to be explored in a constructive manner and can be used to identify the parameters of the system which are particularly subject to uncertainty and that have a significant impact on the overall outcome of the assessment.

Degradation and loss of ecosystems, and subsequent loss of their associated services, constitute a reduction in natural capital. Whether or not this implies an unsustainable path depends on the extent to which one believes that the ecosystem services provided by natural capital can be substituted for by other forms of capital. Whatever the case there is a great deal of uncertainty about both the consequences of ecosystem service degradation and loss, and the ability to generate substitutes. Given this uncertainty, and the potential for catastrophic change, many would argue for a precautionary approach, in which case current rates of biodiversity and other natural capital depletion are a source of serious concern for sustained maintenance of human welfare.

Ideally ecosystems would be managed with sustainable development in mind. In practice, there are a number of acknowledged reasons why ecosystem degradation continues unabated. These reasons mainly include market failure and poor governance. One of the key causes of market failure is lack of information, and so the provision of information on the economic value of ecosystems can under circumstances contribute to better decision-making. This current lack of knowledge relates both to ecosystem functions and economic values. Poor knowledge of the mechanisms by which bio diverse ecosystems are maintained is a barrier to the development of effective management and assessment protocols.

Risk can be seen as the likelihood of occurrence of a set of factors leading to an undesirable outcome. In this context risk can be seen as a combination of the probability of a hazard occurring and the probability of the system being vulnerable to that hazard, which would then result in a negative outcome. Uncertainty, in general terms, is the lack of confidence in

the likelihood of future events occurring and it is in a way more difficult to quantify. This uncertainty may arise from different aspects and steps in the process.
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Therefore when modelling natural systems it is always better to start with the simplest conceptualizations and mathematical representation given these systems' complexity. Models can then be made more complex following a stepwise approach, by changing assumptions and representations if and as these prove unable to simulate realistic behaviour of the target system. In this context 'realistic' is defined in terms of ability to simulate the correct qualitative behaviour of the system as it changes in time under natural forcing or in response to a perturbation, and to generate values of the state variables that are within observed envelopes of variation. This is an iterative learning process that would lead to an improved representation of the system and therefore would improve our understanding of the system functioning. Following this process would result in reduced uncertainty which would increase our confidence in the model and in its outcome.
The design of the model, as well as the assessment of its suitability to the task in hand, including the undertaking of sensitivity analysis, is the responsibility of the scientists. During the presentation it can be made clear to stakeholders what the sources of uncertainty may be and what was done to address them during the process. When presenting the model to the

stakeholders it is most likely and indeed desirable that an interactive process takes place. Stakeholders may provide inputs and suggestions that may lead to changes in the modelling approach. The processes previously followed to reduce uncertainty (described above) may need to take place again (not in the presence of the stakeholders, although a simple explanation should be provided). When running sensitivity analysis there are standard procedures that should be followed, however it would be important to involve stakeholders in decisions such as which parameters they may think are important and in which they may interested in assessing any overall impacts resulting from any alterations in these parameters by a pre-defined percent. This would allow stakeholders to evaluate model sensitivity to specific parameters and as such improve their understanding of uncertainty.

3.3 Comparison

Provide a summary of each of the scenarios in a comparative way in order to point out differences. Make sure to stay coherent with the initial parts of your presentation and always refer to the audience's lifeworlds, i.e. to impacts for them.
Give time to the audience to reflect and to ask open questions.

3.3.1 Comparing Scenarios

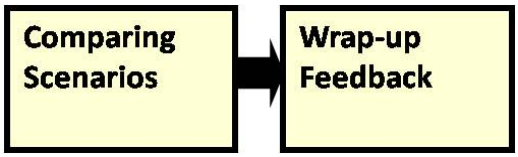

Figure 9) From comparison to wrap-up

Now that we have a series of figures which describe what our model is doing as it is run, either as an end point value, or a description of how that variable is changing, we may want to consider comparisons between our scenarios. In order to provide support of decisions based on these scenarios, we need to be able to provide information to the audience in such a way that we can compare them. We are fortunate in that our indicators have been developed with the reference group in such a way that we have objectives.
Other variables within our models may however be much more ambiguous. Let us consider for example fisheries; to an ecologist, a decrease in landings from a fishing fleet may be considered the positive outcome in that the ecological pressure being applied to a fish stock is reduced. However this standpoint may be the exact opposite from that of a fisherman, to

whom a decrease in landings could mean a catastrophic reduction in his or her income and therefore his or her family's social wellbeing.
It is not for us as providers of information to make these value judgments but only to provide information in such way that they can be discussed by the stakeholders and policy makers. We must therefore be very careful to provide information in an unbiased way.

3.4 Wrap-up

If there is a demand for giving more in detail explanations, do this by splitting up into different sessions / work groups / or convene additional meeting. Treat every subgroup equally and do not give preference to more or less powerful / more or less active stakeholders.
If done several presentations in different meetings for different stakeholder groups, bring them together for a wrap-up session and give a summary of the different meetings and offer time for discussion and dialogue. Introduce the next steps and necessary preparations for deliberation. Introduce the next steps and transfer to deliberation.

3.4.1 Run a requested scenario

A way to show the usefulness of scenarios to the audience is to use the rather fast response time of the models. This implies that the audience can request a given scenario in the form of changing parameters that can be controlled, e.g. a xx% reduction in nutrient emission or a yy% in a model increase in fishing effort, and the results can immediately be shown.
If running a model ‘on demand’ for the audience, you will have to be even better prepared for feedback questions because you will need to do ad-hoc interpretations of the results if a certain parameter is changed / a policy option is modified in the course of a meeting.
When presenting the scenarios in such a way, you will come to the point where the question is raised ‘what do I need to do in order to change this scenario, this future’. This implies the opportunity for the reference group to ‘influence’ the system. The scientist will have to be well prepared to answer those arising action-oriented questions. These are tackled more in detail in the Appraisal Step during the interpretive analysis.

3.4.2 Further demands

If there is a demand for going into detail for an in depth analysis of the implementation of measures or interpretation of different scenarios, this should be done by splitting up into different sessions / work groups. Every subgroup needs to be treated equally.

If you decide from the beginning to do separate forums with the different stakeholder groups before bringing them together, make sure that in every different group, the exact same scenarios are used – just that the way they are presented will have to be adapted specifically to the group and the group's interests and stakes.

4. (Manage) Deliberation

4.1 Introduction to conducting deliberations

Deliberation refers to a specific approach to science, society and policy engagement: a process in which individuals and organisation are open to scrutinising and changing their preferences in light of persuasion (but not manipulation, deception or coercion) from other participants. Deliberation therefore refers to an open process of discussion or exchange of knowledge and ideas. From this perspective, there are a number of opportunities for deliberative processes within the Output Step and these include for example, exploring different mixes of policy measures, exploring technical alternatives and scenario results, particularly the costs and long term benefits and trade-offs of different scenarios. Earlier opportunities for deliberation within the System Approach Framework process have included identifying the policy issue and the feasible options or scenarios during the initial step of the SAF (Issue Identification).

The following paragraphs provide basic introductory guidelines on science and policy deliberation specific to the Output Step and organising and facilitating a deliberative forum. The forum refers to some vehicle (e.g. open meeting, hearing, workshop or online space) for enabling a conversation between scientists, policy-makers and the stakeholders of our reference group.

Deliberation is clearly one form of science-society and science-policy engagement and other forms can be pursued depending on the availability of resources and the baseline of existing interactions with stakeholders within the System Approach Framework process. Engagement can take the form of 'education' which would relate to the reference group becoming informed of results. 'Consultation' would refer to a process through which the users seek feedback from stakeholders but do not engage in discussion and exchange of ideas. Often computer based aids are used by conveners and facilitators of such consultations. Such Decision Support Tools or Decision Support Systems refer to a wide range of computer-based tools (simulation models, and/or techniques and methods) developed to support decision analysis and participatory processes. A Decision Support System consists of a database, different coupled resource-dynamics and socio-economic models and is provided with a

dedicated interface in order to be directly and more easily accessible by non-specialists (e.g. policy and decision makers). Decision Support Systems have specific simulation and prediction capabilities but are also used as a vehicle of communication, training and experimentation. Principally, Decision Support Systems can facilitate dialogue and exchange of information thus providing comprehensive insights to non-experts and support them in the exploration of policy options.

Research focusing on the science and policy integration process stresses that deliberation is the most effective form of science and policy integration to increase social learning and to achieve more useful and innovative approaches to environmental management. When conducting a deliberation process involving the 'real world' within the Output Step, it can be worthwhile to build plans for action as much as possible from the following points:

- Policy-making happens on its own timescales and is influenced by many other inputs beside scientific research (SMP, 2005). Effective approaches to science-policy relationships are not based on a linear process in which scientists deliver findings to policy-makers at the end of their research and these findings then influence policy as in a cause-effect chain of events. The integration of science and policy needs to be considered as an iterative process with a requirement for a flow of ideas. This re-emphasises the need to engage with stakeholders throughout the System Approach Framework process. For the Output Step this has important implications: one is that policy-making is not only driven by science and that there may be several other factors influencing decision-making. Therefore expectations about the outcomes of the SAF process may need to be moderated: in an iterative loop, the Output Step is important both as the outcome of a complex process and as a new start for problem-scaling for a next loop of the System Approach Framework.
- Communication is not only about passing information and the challenge is therefore simply not one of ensuring that the information is transmitted more effectively. Neither is improved science-policy integration merely a question of making existing science more effectively applied (Green, 2008). But scientists need to reflect, learn and challenge their own understandings within the confines of a science-policy integration process. The Output Step should therefore be used as an opportunity to articulate the dynamics of this learning process. In preparing accompanying documents for the Output Step, scientists should reflect on the development of the SAF simulation models from the context of input from policy-makers and other

stakeholders, as well as providing information on the perceived institutional and policy-making context of the models. This also contributes to changing the dynamic of the deliberation from one of authority based informing to a situation which is more participatory learning oriented.

- ‘Citizens’ and ‘Governance’ are often treated as black boxes and the debate on public engagement is seen as involving citizens as stakeholders on one hand and government as stakeholders on the other (Innes and Booher, 2004). However, there are a wide range of participants in a policy process: individual citizens with widely different rights and interests, organised-interest groups, firms and multinational conglomerates, profit- and non-profit non-governmental organisations, planners and decision-makers – to mention only a few. We know from political science research that these influence on one another as well as on the end result of policy-making. Where possible this needs to be considered when planning ‘real-world’ science-policy consultations. This is particularly important within the Output Step. A more than superficial understanding of how these different groups interact in a certain coastal setting can inform us about how best to present results and conduct deliberation. Reflecting as broad a range of interests as possible allows the collective representation of the consultation forum to reflect the full complexity of the coastal context. This will be very important in debating within this context the most effective, suitable and desirable human-activity in relation to coastal ecosystems – and if need be, the most desirable policy change.
- Science is not a homogenous entity in the form of: a single scientific community. Both the unity and the plurality in the sciences are important to be aware of when working to improve the integration of science and policy. This idea carries the recognition that there are multiple scientific viewpoints on how to identify and solve policy issues. Conversation is required within and between the sciences in an open and non-hegemonic way to explore new ways of thinking through the functional relations between the ranges of scientific knowledge carriers. The material presented in the deliberation forum should therefore attempt to reflect such disciplinary debates with as much transparency and scientific honesty as possible: i.e. with open arguments for the adopted scientific perspective within the model. Assumptions and methods should be clearly articulated in the forum, as should any conflicts between long-term sustainability concerns and shorter-term management or policy-making issues. Prepare a deliberation forum.

4.2. Prepare a deliberation forum

Prepare the forum in either a separate session or a session connected to the stakeholder forum. Follow the same organization steps as done for the previous engagements and make introduce the concept of deliberation and the tools used to the invited stakeholders before the start of the deliberation session.

4.2.1 Instructions for preparation of deliberation forum

Although formalized deliberation with a designated 'Deliberation Support Tool' (e.g. the KerCoast Deliberation Support Tool) will be introduced here, not all science policy consultations in Coastal Zones will be carried out with a specially tailored deliberation forum and with the help of such tools. In some cases an ICZM initiative already exists within an area, such as an established community forum, a coastal zone council or a small council of 'experts' with established rules for deliberations and decision-making.
Nor is it necessary to employ the most advanced deliberation tools in all settings, in many cases a structured discussion with a facilitator and a blackboard/pen and paper (possibly using the frame of the KerBabelTM Deliberation Matrix) can do the job. In other cases computer-based deliberation software can be helpful. In yet other cases the coastal policy-making process can be part of a larger 'Deliberation Support System' in a municipality or a province – or be nested in a comprehensive sector cross-cutting E-governance structure. In the case of policy issues with a spatial character, a GIS-based Decision Support System can be advantageous because of the visualization power in these tools.

Therefore these generic instructions for science-policy consultations do not only pertain to the use of a formal deliberation tool, but to all consultation arenas where some form of deliberation takes place.
Also it should be noted that these instructions should be used both for situations where the scientific input is formalized in a comprehensive systems model with social-ecological components - and in situations where the scientific input is more fragmented and in the form of separate reports addressing different sectors in the ICZM Science/Policy theatre. It should also be noted that in all variants of Science–Policy interaction, the existing 'real world' institutional and governance structures will be a heavy factor that will always be present, constrain and condition the efforts to constitute an ideal or de-coupled deliberation forum. Both facilitators and reference group will therefore be obliged to find good, working

compromises between the ideal and free deliberation format and the practical solutions that can be implemented without too many obstacles and disappointments.

These are the steps to follow to prepare a deliberation forum

Step 1:

Revise the pre-consultation information that has been gathered for the initiation of the SAF application (Issue Identification and Design Step) about the history of the situation in the coastal zone, about the issues likely to be raised, and re-consider the information about relationships among the reference group that have been noticed throughout the process, and about the concepts and language used by different parties. Before beginning any interviews or focus groups communication, the facilitator should collect sufficient background information on the current (total) coastal context, as this might have changed since the upstart of the SAF. In some cases it may provide enough information by carrying out a desktop mapping exercise without the need for interviews or focus groups.

Step 2:

Use information from the prior steps to determine who could and who should participate in a deliberation forum. Use the 'snowballing' technique. It might be necessary that facilitators assure some stakeholders that participating in the interview of the Issue Identification phase in order to define the policy issue does not require them to participate in a subsequent collaborative process.

Step 3:

Consultation preparation: Based on the scenarios shown in the Stakeholder Forum, consider if a few dimensions seem more important than others and prepare an initial list of what the policy options for the deliberation forum will be. Ideally all policy options on which the scenarios were based should be classified in terms of their varying relevance and importance in relation to the tackled policy issue so that they upon request can be entered into the deliberation at a later stage.

Step 4:

Consultation preparation: For each policy option, define how the reference group members relate to each other and to the option. In the techniques developed in the Issue Identification lies the identification of the relationships between and among stakeholders, and stakeholder relationships to the policy issues. This mapping methodology is focussing on the big issues before zooming in on key issues. It is important to see this as the first step in a collaborative process to reach a collective decision (a policy) which can improve the situation in a

particular coastal zone. To achieve this, it is important to choose a diverse range of knowledgeable stakeholders who together can muster the insights needed to give a complete picture of the complexity of the coastal context.

Watch out: this has already been the basis for the Stakeholder Forum. Ideally you are now continuing the process with the same or similar group of people.

From the list of stakeholders and policy makers, the facilitator can now choose a 'short-list' of reference group members (not too many) for the first-round of deliberation. As a minimum the forum should include representatives from: a) government agencies, b) private enterprise and c) public-interest groups. Before the deliberation starts it is necessary to check the list of stakeholders for comprehensiveness and to validate it against the real world situation.

Step 5:

Consultation preparation: Prepare crucial questions for the opening stages of the deliberation forum – either as interviews or as focus groups. Prepare both 'primary questions' – open ended opening questions – and "secondary questions" that can draw out more details from a complex theme. Decide the time, date, location and estimated duration of the deliberation process and – if possible – prepare a list of questions to be raised, or at least a list of themes to be covered.

Step 6:

Invitation to deliberation forum: The convenor must invite participants by explaining again the purpose SAF approach, the selection of participants, this step of the process, that of the deliberation process between stakeholders over issues and scenarios, of the assessment process and how the information will be used afterwards. In the invitation; also introduce the facilitator, the convenor and the assessor and their background and mandate. The convenor and the assessor can be the same, but it is crucial that the person maintains neutrality and confidence with the stakeholders. The invitation should also promise confidentiality – and include an 'informed consent form'. Finally the invitation should motivate the participants to keep on partaking in a collaborative process where everyone carries a responsibility for the collective result.

Step 7:

Prepare for the post-consultation analysis of findings beforehand: Be prepared to group the responses into typical categories (use both coding and triangulation). It is usually best to categorize according to the activities stakeholders are engaged in, or their sector; and to classify stakeholders according to their function, rather than their legal status. If possible, prepare to generate maps that can be used to present the information from the Stakeholder-

Policy Mapping the different methods for preparing those maps are provided in Issue Identification and Design Step. In most cases, sufficient information is available in order to generate these maps before the deliberation starts. However, it is important to check during the deliberation forum that these maps are precise and comprehensive and that they really catch the diversity and range of ideas/interests/opinions represented among the stakeholders in total. It is important to keep this diversity and the variety of opinions for as long as possible into the deliberation process and thus make the variations in interests and in the positions understandable for the participants in the collaborative process of policy-making.

4.2.2 Content and procedure necessary for preparing deliberation using KerCOASTS Deliberation Support Tool

If you as facilitator choose to use the formal Deliberation Support Tool (software) for the consultations, you will need, in addition to the preparations carried out above, to prepare a number of additional steps. You will need to get familiar with the tool and run some 'dry runs' to master the details of how to use the tool in a social setting. Participating in an offered training session is strongly advised. It is also advised that the facilitators are familiar with the theoretical grounding for the deliberation matrix technology and that you can explain this to the participants in the deliberation forum. The basic idea is that of communicative rationality: sensible solutions can be reached when deliberation is free and when only the power of the arguments makes you change your opinion, not other power relationships. Describing this frame is probably necessary to gain acceptance among the reference group for using such a deliberation tool in a specific ICZM context.

Before inviting the reference group to participate in a deliberation supported by the KerCOASTS Deliberation Support Tool, you should carry out the following steps:

Step 1 Design a new debate

The facilitator has to decide a title of a new debate and to define the context of the Deliberation Matrix creation, i.e. whether it is a particular study site, whether it is a more general debate over coastal issues, whether it is a generic debate etc. For later reference and to give others access to the debate, the debate also has to be described within the toolbox. Finally the debate parameters have to be identified and defined beforehand.

Step 2 Choose the debate parameters

This needs a decision on whether the debate is participative or not and whether the debate shall be open or close. Most of the time, a deliberation will be kept open as long as it is not finished.

Step 3 Select the different axis

The Tool gives the deliberation forum the opportunity to debate along three axes: the first dimension, the second dimension and the third dimension. For each of these dimensions, one can choose between “Actor”, “Scenario” and “Issue” (called respectively stakeholder, regulatory option and sub-issue above). The most practical way to use the Tool is to assign one axis to actors, one to scenarios and one axis to issues, but you have to decide which names (and 8 letter acronyms) to use for each of these categories beforehand. In order to rename one of the axes, you can choose “other” and write the new name in the box.

Step 4 Choose colours corresponding to each vote

Choose e.g. from GREEN for Good/Agree to RED for Bad/Disagree. Change the heading of the answers if you decide that other responses are most appropriate.

These are sufficient preparations to build your Deliberation Matrix. After submitting, you can refine the presentation menu for the matrix to suit the composition of the deliberation forum. For the same debate it s possible to create many deliberation matrixes – and you have to think through which of these you will really need to include in a particular session.

4.3 Deliberate with Decision Support Tools or Systems

Chose to deliberate with the KerDST Software or with KerDST on paper. For both, follow thoroughly the instructions in the KerDST manuals and supporting information and ensure a skilled facilitator to be present when using the matrixes.

4.3.1 Overview of Decision Support Tools or Decision Support Systems

The terms Decision Support Tools or Decision Support Systems refer to a wide range of manual or computer-based tools (simulation models, and/or techniques and methods) developed to support participatory processes and decision analysis. A Decision Support System can consist of a database, different coupled eco-dynamic and socio-economic models and can be provided with a dedicated interface in order to be directly and more easily accessible by non-specialists (e.g. policy and decision makers). Many Decision Support Systems also have specific simulation and prediction capabilities, but are mainly seen as vehicles of communication, training and experimentation. Principally, a Decision Support

System can facilitate dialogue and exchange of information, thus providing insights to non-experts and support for them in the exploration of policy options.

We commonly distinguish between the following categories of deliberation or decision support tools/systems:

Communication-driven Decision Support Systems

Communication-driven Decision Support Systems are support systems where more than one person is working on a decision making or policy making task that is shared with others. The communication can be conducted with manual aids, e.g. “Post-it® notes”, or different forms of more or less advanced computer based systems for registering, storing and aggregating individual opinions and changes in these opinions as the communication/deliberation process advances

It is important that the graphical features of a Decision Support System support the communication between stakeholders with different backgrounds. Therefore visual aids in Decision Support Systems also become more and more important when audiences are composed not only by policy makers but also by citizens. Communication capabilities that help in fostering public participation are particularly developed in Deliberation Support Tools. For instance Group Decision Support Systems that support collaborative decision making.

Knowledge-driven Decision Support Systems

Knowledge-driven Decision Support Systems provide specialized problem solving expertise stored as facts, rules-in-use, practical procedures, or in similar structures. A multidisciplinary team involved in the analysis of a coastal problem/issue can use such praxis-based knowledge to establish a common language and think in a joint and structured way. Criteria, objectives and constraints about the problem thus become more explicit through the whole process of development and application of a Decision Support System.

Data-driven Decision Support Systems

Data-driven or data-oriented Decision Support Systems emphasize access to and manipulation of a database or time series of internal community or company data and, sometimes, external data. The practical application of a database management system for decisions to allow the organisation, to facilitate easy and ordered access to otherwise raw data and to facilitate: integration of different type of knowledge (e.g. local and expert knowledge), disciplines and perspectives in the development of effective and sustainable coastal policies.

Document-driven Decision Support Systems

Document-driven Decision Support Systems manage, retrieve and manipulate unstructured information in a variety of formats, both paper and electronic. They thus allow a wider source of "data" and can thus be more "robust" in many difficult policy decision processes. Specific techniques can be integrated in these kinds of Decision Support Systems to help in the selection of "What is best/ what is good enough?". For instance multi-criteria analysis for the evaluation, benchmarking and ranking of different options identified in coastal development scenarios. Optimisation models integrated in Decision Support Systems can thus help to identify the best among multiple generated alternatives.

Model-driven Decision Support Systems

Model driven Decision Support Systems emphasize access to and manipulation of a statistical, financial, optimization, or simulation model. Model-driven Decision Support Systems use data and parameters provided by users to assist decision makers in analyzing a situation; they are not necessarily data intensive. Thus a model can itself be a Decision Support Tool, and if it is simple enough, it can be a tool that is also directly usable for stakeholders and rights-holders. When such model-driven Decision Support Systems contain optimization and simulation capabilities they can help in the analysis of possible trade-offs and conflict resolutions within a set of alternative options through the development of 'What if' scenarios. It can thus be used to empower coastal citizen groups without them depending heavily on scientists.

Spatial-based (GIS) Decision Support Systems

The use of GIS in Spatial Decision Support Systems allows for the definition of place-specific ecosystem and socio-economic maps that help in the multi-criteria analysis of the problem at hand. GIS components helps both managers and stakeholders in the visualisation of location of measures and impacts, and it can uncover overlaps and border problems. It can also facilitate more exact problem assessment by providing important information for the allocation of coastal infrastructures.

E-governance type discussion support tools

Whilst e-Government has traditionally been understood as being centred around the delivery of government services to citizens through Information Communication Technologies (or ICTs) (Portals etc), e-Governance is understood to extend the scope by including citizen engagement and participation in governance. As such, following in line with the OECD definition of e-Government, e-Governance can be defined as the use of ICTs as a tool to achieve better governance. One goal of e-governance is greater citizen participation. Through the internet, people from all over the country can interact with politicians or public servants

and make their voices heard. Blogging and interactive surveys will allow politicians or public servants to see the views of the people they represent on any given issue. Chat rooms can place citizens in real-time contact with elected officials, their offices or provide them with the means to replace them by interacting directly with public servants, allowing voters to have a direct impact and influence in their government. So far e-governance has thus mainly been used as a means to increase the element of "direct democracy" in connection with election campaigns. Its use as deliberation or discussion support tool has therefore been limited.

4.3.2 Deliberate in a KerBabel^{TM} Deliberation Matrix framework

Coastal zone issues are characterised by complex science-policy problems. These coastal challenges of '(un)sustainability' can be articulated, across their social, economic, environmental and institutional aspects, in a great variety of ways. This is the complex societal context in which we reflect on science and knowledge as a resource for new visions of sustainable coastal futures and collective pursuits of well-being. Choosing a deliberative approach, the aim is to involve stakeholders in demonstrating the nature of the problem and allow crafting new alternatives.

The KerBabelTM Deliberation Matrix is a methodological framework for including policy/stakeholders in the SAF – particularly in the initial phase of Issue Identification and in the final deliberation phases during the Output Step. The purpose of the Deliberation Matrix is to facilitate stakeholder involvement and deliberation processes by providing a multi-stakeholder multi-criteria deliberation framework.

The methodology behind it is grounded in theoretical and empirical developments on social choice theory. The basic idea is that of "communicative rationality": sensible solutions can be reached when deliberation is free and when only the power of the arguments makes you change your opinion, not other power relationships.

In practice, the social choice problem is presented along three dimensions: stakeholder categories, sub-issues (to the main policy issue under discussion) and regulatory options in order to structure a sustainability problem in a deliberative perspective. These three dimensions can be represented using the Deliberation Matrix also called the "Cube". Each stakeholder is then invited to express his opinions over each combination of sub-issues and regulatory options.

Although resting on the same methodology, two options for the use of this framework are available to the user. You can represent and record the deliberation results using the online KerCOASTS Deliberation Support Tool – to be found on http://kercoasts.kerbabel.net/. Another option is to use the same framework for analysis to structure the discussion, not using software, but a blackboard or pen and paper along with colours or "Post-it® notes" to help distinguish the opinions of the different stakeholder groups.
The general methodology for using the KerBabelTM Deliberation Matrix is the same and is explained below. More details for using respectively the Deliberation Support Tool and the paper version are given when pending.
The final choice towards one or the other option strongly rests on the general context of the deliberation (e.g. relationships and trust among the group) as well as on the facility the stakeholders -and the facilitator- have for working with computers. Anyway, you will see that opting for this Deliberation Matrix framework can be of help for the stakeholders to understand how beneficial structure and robustness are to help deliberate on the future of their complex coastal system.

Facilitate deliberations using the KerBabelTM Deliberation Matrix as a structure and as a Tool

The figure below presents as a flow diagram the five steps used for deliberation facilitation, along with the corresponding structuring in the Deliberation Matrix -also known as the "Cube"- and the KerCOASTS Deliberation Support Tool.

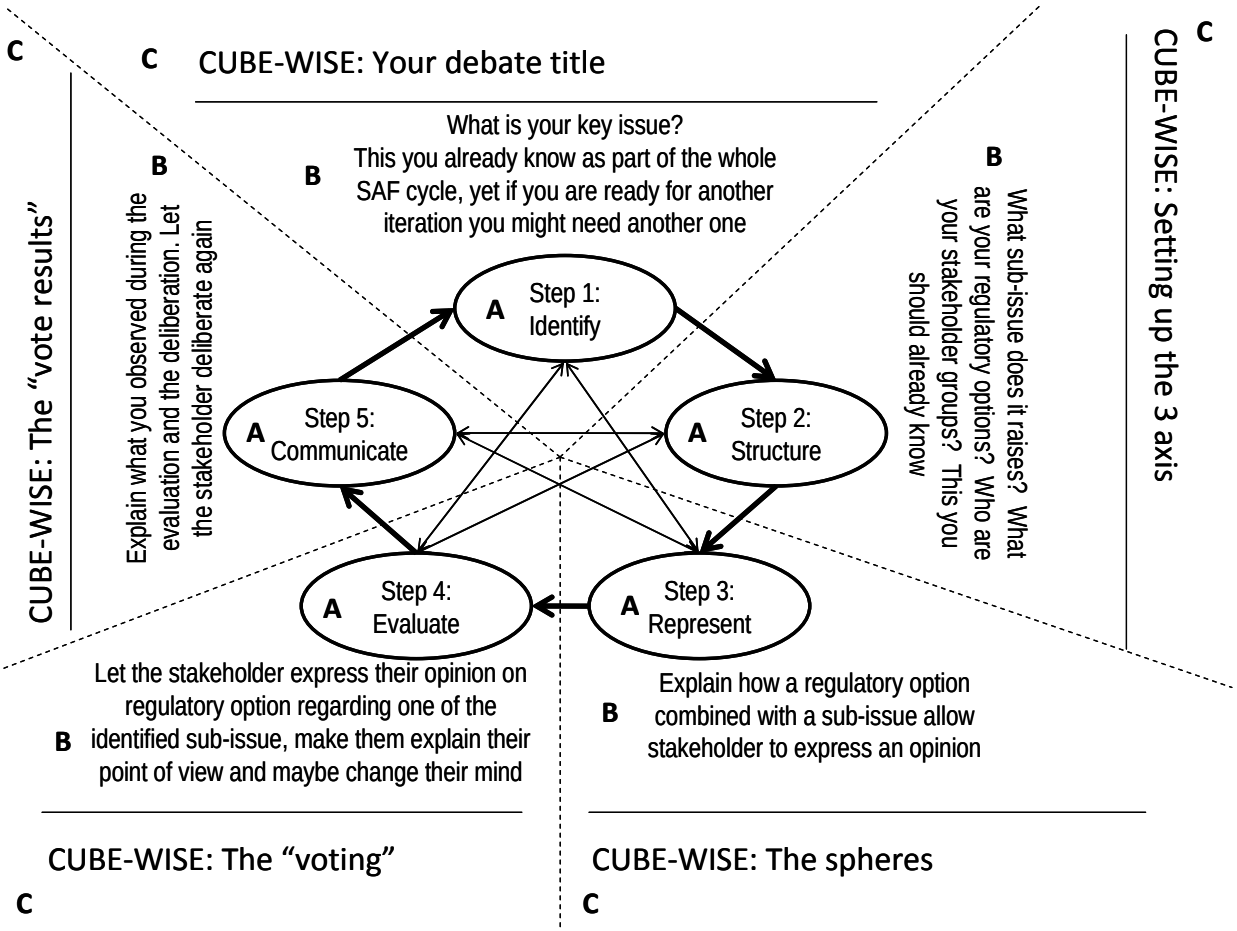

Figure 10) Deliberation

Step 1 and 2: preparing the deliberation

A) General preparation

Revise the pre-consultation information that has been gathered for the initiation of the Isse Id and Design Step about the history of the situation in the coastal zone and about the issues likely to be raised, reconsider relationships among stakeholders that have been noticed throughout the process as well as the concepts and language used by different parties. Before beginning any interviews or focus groups communication, the facilitator should collect sufficient background information on the total coastal context (which has ideally already been done in order to do the presentation of the scenario results). In some cases it may provide enough information by carrying out a desktop mapping exercise without the need for interviews or focus groups.

B) Preparation for a robust structuring

Assess the relevance of each sub-issue that is associated with your key issue. The purpose of this assessment is to identify a limited number (3-5) of sub-issues in order to facilitate a clear focus on the critical elements that could be raised by the stakeholders. For the sub-issues that

you want to consider write a small text explaining what these precisely entail. Write a descriptive text for each regulatory option as well (3 would be a reasonable number but up to 5 is manageable). If these regulatory options are the subject of simulation model runs, this is a unique opportunity to write down the narrative associated with the regulatory option. Identify clearly which members belong to the stakeholder groups you have categorised.

C) Preparation for using the "Cube"

This step only pertains if you as facilitator choose to use the KerCOASTS Deliberation Support Tool. You need to technically master this Deliberation Matrix software to be able to use it in a deliberation setting with your stakeholders. It is thus necessary to do some "dry runs" with the Tool e.g. create a debate, set up a new matrix with the chosen axis precisely defined etc.

Step 3 to 5: conducting the deliberation

A) General preparation

You need to be ready to clearly spell out to the stakeholders the interest of focusing on a sub-issue-regulatory option pair. The purpose here is to allow them to express and justify their opinion, explain the role of knowledge and science in the formulation of this opinion, and maybe express needs for more science, be it supplementary simulation model runs, new models or totally different science. Two key "opinions" are of interest during the Output Step:

1. Opinions expressing the inability to express an opinion due to a lack of desired knowledge;
2. Differing opinions from different stakeholder groups that might be reconciled by a clearer understanding of how the system is working.

   These "opinions" belong strongly to the science and policy integration world. It is quite important that you regularly, in the course of the deliberation, keep track of changes and progress towards some sort of agreement between the stakeholders regarding the various sub-issue-regulatory option pairs.

B) Preparation for a robust structuring

In order to achieve what is described above, it is wise to prepare for each stakeholder a table where all the sub-issues form the rows and regulatory options form the columns, the cells being blank and sufficiently big for the stakeholders to write their opinion within the cells, using text or a colour code e.g. from GREEN for Good/Agree to RED for Bad/Disagree (see illustration below). This table will be accompanied by the text describing the sub-issues and

the regulatory options. Stakeholders will need to be able to read this text while working on the tables.

Stakeholder name / category: .....

	Regulatory option 1:	Regulatory option 2:	Regulatory option 3:	Regulatory option 4:	Regulatory option 5:
Sub-issue 1:					
Sub-issue 2:					
Sub-issue 3:					
Sub-issue 4:					
Sub-issue 5:					

Good « So-good » Bad I don't know N.A.

Figure 11) Deliberation on Scratch

C) Preparation for using the "Cube"

If you choose to use the KerCOASTS Deliberation Support Tool, prepare yourself for a real time voting exercise with stakeholders, by means of the debate and matrix that you have created in the course of steps 1 and 2. You can opt for other alternatives using this methodological framework. You can for instance draw on the software for an initial representation, let the stakeholders vote and express opinions using the paper based table and enter their vote afterwards within the DST in order to help represent where they stand. You can also choose not to enter at all into the software and gather all completed tables on a blackboard to allow comparison.

Three main complementary ways to interpret the Deliberation Matrix results exist -whether it is represented in the DST or on paper:

- The first one is by stakeholder category, presenting stakeholders' judgments sub-issue by sub-issue for successive regulatory options (i.e. comparing the results of the table above for different stakeholders);

- The second one aims to make stakeholders share their opinions on a specific regulatory option. By doing so, each regulatory option can be evaluated sub-issue by sub-issue by each class of stakeholder (i.e. examining the votes of all the stakeholders regarding for instance regulatory option 1 –first column in the table above- across the sub issues);
- The third way to interpret the results of the Deliberation Matrix is as an analysis of judgements over the sub-issues: the evaluations stakeholder by stakeholder of each regulatory option, with reference to the studied sub-issue (for e.g. sub-issue 1 –first row in the table above- comparing the opinions of all the stakeholders along regulatory options).
- Actually, each of these interpretations implies focusing on one dimension, layer or "slice" of the "Cube", represented in the Deliberation Support Tool, the compared judgements being gathered in a rectangular array of cells.

During the deliberation process, stakeholders express opinions on regulatory options, using the sub-issues as criteria to compare them. Listening to each stakeholder's perspective concerning those regulatory options make us discover the diversity of points of views (and their coherence). The resulting dialogue between stakeholders along this deliberation process possibly opens the door to change of minds. The social learning that can take place when comparing opinions is thus a dialogue on their acceptability as alternatives.

Suggested reading: Vanderlinden, J-P., Bremer, S., O'Connor, M., Douguet, Jean-Marc (2011), Reviewof the Deliberation Support Tool and its use in coastal contexts. Spicosa Project Report, Guyancourt: Paris, Université de Versailles-Saint-Quentin-en-Yvelines. Available at http://www.coastal-saf.eu/output-step/refs.shtml

4.4 Science Policy Consultations and analysis without using a software based DST or DSS tool

Chose to deliberate without using a software based DST or DSS tool if not adequate for your reference group or cultural and communication habits.

4.4.1 General information on consultation and analysis without using software based DST

Although formalized deliberation with a designated Deliberation Support Tool (KerCOASTS DST) has been tested within the reference project of SPICOSA, in the real world the fact is that not all science-policy consultations in coastal zones can be carried out with the help of such tools.

In some cases an ICZM initiative already exists within an area, such as an established community forum, a coastal zone council or a small "council of experts" with established

rules for interventions, hearings and decision-making. Here it may be easier and more useful to utilise these groups directly for the policy issue mapping and science consultation exercise. In some cases a Maritime Spatial Planning Process will already be in progress – maybe as part of the implementation of the
EU Integrated Maritime Policy or other frameworks or directives. As the maritime environment is both 3-dimensional and fluid, such spatial planning might be founded on a systems based approach akin to the SAF approach, and even on an ecosystem approach as one of the intentions in the new Common Fisheries Policy.
The European Commission has issued a 10 points roadmap for such spatial planning which is intended to facilitate a more rational use of the maritime space; this should be checked before embarking on a consultation process in a situation where Marine Spatial Planning is taking place.
Spatial planning usually means more involvement of local and regional governance institutions, and less dominance of sectoral agencies. In that respect the very idea of "integrated" can imply an opening up the policy making process so that less goes on behind the closed doors of sector management and sector policy making. Regional and local government is usually closer to stakeholders and organised interests than national and union level policy makers, thus the distinction between stakeholders and policy-makers becomes less clear when spatial maritime planning becomes an important part of the overall governance process. This is however in line with the long term objectives of the EU Integrated Maritime Strategy, where stakeholders are intended to be more part of integrated maritime governance. In these processes, GIS-based Decision Support Systems are increasingly being applied.
Such a closer integration of stakeholders in maritime – and coastal – governance has several consequences which it is important to be aware of when conducting a science-policy consultation: When it becomes less clear when the participants are stakeholders and when they turn into policy-makers, it also becomes more difficult to present the stakeholder relations to various issues as final attachments to a systems model. Social science teaches us that the human nature is such that stakeholders, as policy makers, might see other scenarios, solutions and coalition potentials than they do as stakeholders. Thus a science policy consultation might easily assume the character of a political game where some stakeholder strategies are saved for later use in a 'closer to decision' phase of the governance process.

It is also important to be aware that so-called stakeholder platforms – formed to unify diverse stakeholder interests - can conceal important differences that can later surface in the political processes themselves. The broader such stakeholder platforms are, the more real differences are likely to be hidden. Therefore it is crucial for the science-policy consultation that a minimum amount of social science based analysis of the interests of the various stakeholders is undertaken when a formal Decision/Deliberation Support Tool or System is not applied. Guidelines for such analysis of the objective interests of important coastal actors and of the institutional arrangements (including property rights) constituting these, are explained in some detail in the Issue Identification and Design Step of the SAF- process.

With only a modest level of formalization, it is still possible to conduct a meaningful science-policy consultation process. We have for instance seen before how a “manual” deliberation process can be conducted, using the same theoretical framework as the KerCOASTS Deliberation Support Tool. However, at a consultation meeting, more demands are put on the natural scientists to explain the workings of the conceptual model in understandable language. And more demands are also put on social scientists to observe and analyse the real interests of various stakeholders and policy makers – and to expose these in common – or public – arenas.

Key References

Borner, J. (2011): Nachhaltigkeitsmanagement: Moderne Kommunikation als Konstruktion von Realität nachhaltiger Entwicklung. In: Winzer, P., Edt. (2011): Entwicklung im Wuppertaler Generic-Management-Konzept. Aachen, Shaker Verlag.

Borner, J., Bittencourt, I., Heiser, A., Edts (2003): Nachhaltigkeit in 50 Sekunden. München, Oekom Verlag.

Chandler, Daniel (2001): Semiotics: The Basics. London, Routledge. Also available at URL: http://www.aber.ac.uk/media/Documents/S4B/ (visited 01 March 2010)

Douguet J.-M., Vanderlinden J.-P., Baztan J., (2011): KerCoasts, a multimedia tool for learning and deliberation support technology on coastal zone management. A user guide, REEDS Research Report, REEDS. France, Versailles, University of Versailles Saint-Quentin-en-Yvelines.

Eco, Umberto (1976): A Theory of Semiotics. Bloomington, Indiana University Press/London, Macmillan.

Flusser, V. (1995): Die Revolution der Bilder. Mannheim, Bollmann, Flusser-Reader zu Kommunikation, Medien und Design, p.8.

Golüke, U. (2001): Making Use of the Future – Scenario Building as a Tool to Solve

Regional Autonomy Conflicts. Working-Paper. München, Centrum für angewandte Politikforschung.

Guggenheim D., Director (2006): An Inconvenient Truth: A Global Warning [DVD]. Hollywood, Paramount.

Guimarães Pereira, Â., P. De Sousa Brilhante, Edts. (2005): Knowledge Assessment Methodologies Fall School Manual, PB/2005/IPSC/0384, European Communities.

Habermas, Jürgen (1981): Theorie des kommunikativen Handelns 1, Handlungsrationalität und gesellschaftliche Rationalisierung, Frankfurt am Main, Suhrkamp.

Jakobson, R., Edt (1971): Selected Writings, Vol. 2. The Hage, Mouton.

Involve (2005): People & participation – How to put citizens at the heart of decision-making. Boston, MA, Beacon Press. Also available at: http://www.involve.org.uk/assets/Uploads/People-and-Participation.pdf (03.01.2011)

Leal, W. and Borner, J. (2005): Communicating Sustainable Development, A practical guide for communications and media professionals. For the Worldbank, Berlin, Hamburg, Santiago, TuTech Innovation GmbH, KMGNE.

Lonergan, S. (2004): Introduction in Understanding Environment, Conflict and Cooperation. Paris, United Nations Environmental Programme.

Luhmann, N. (1989): Ecological Communication, Chicago, University of Chicago Press.

Lull, J. (1995): Media, Communication, Culture. New York, Columbia University Press.

Meadows, D., Meadows, D., Randers, J. (2004): The Limits to Growth, The 30-year Update. London, Earthscan.

Michelsen, G., Godemann, J., Edts. (2007): Handbuch der Nachhaltigkeitskommunikation, Grundlagen und Praxis. Muenchen, Oekom Verlag.

REEDS research center for ECOST, SPICOSA, THESEUS (2010): KerCoasts, a multimedia tool for learning and deliberation support technology on coastal zone management.

France, University of Versailles Saint-Quentin-en-Yvelines. Available at URL: http://kercoasts.kerbabel.net/

Sharma, S.K., Starik, M., Edts. (2004): Stakeholders, the Environment and Society. Cheltenham, Edward Elgar Publishing.

Stern, N. (2006): Stern Review, The Economics of Climate Change. London, HM Treasury.

Tàbara, D. (2006): Participatory Sustainability Assessment using computer models. In P. Vakerling et al. Puzzle Solving For Policy – II. International Institute of Integrative Studies, European Forum for Integrated Environmental Assessment, Maastricht.

Woodcock, G.L. (1986): Planning, Politics and Communications. Gower Publishing Company Limited, Aldershot.

Annex 1) Using Social Tools in the Ouput Step

Institutional mapping	
Role within the output step	Your institutional map focuses on the **rules** which govern actors (e.g. who does what) and is a **guide to action**: therefore it should play an important role in the output step which focuses on tackling the coastal system and **returning to the 'real world'**. In conjunction with stakeholder mapping, at a basic level revisiting institutional mapping enables those with **prescribed roles and responsibilities** in the coastal zone to be **identified** for the purpose of participating in the stakeholder The map is a **prediction tool**; highlighting that certain features of the social system (e.g. rules, policies, laws) will be encountered at one point or another in an impact-response chain of actions and/or a decision-making process. It can also be viewed as a **prescriptive tool** assisting the identification of those aspects of the system that can be changed more easily by policy making and the variables which are more difficult to influence; thereby identifying quick changes and those where long-term planning is required. This is important information for discussing and agreeing most **feasible** management and governance option scenario(s). The map can provide some perspective on **differences** between the documented policies or the **model generated policies** and how these policies will likely be implemented in the **real world**. For example, the analysis of informal rules (e.g. cultural views of justice, equity) shows how well formal rules operate in practice. This provides a clearer basis for identifying **best options** for action and change in the system towards more sustainable coastal management.
Value/Key advantages of including the tool.	**Differences and areas of common ground** which are potentially concealed in stakeholder or deliberation forums and which are important in the political process of policy-making may be identified by utilising the maps. The institutional mapping exercise gives those convening the deliberation process **important context information** regarding the space that policy-makers have to take action and different organisations' **relationships** to each other. Identifying the formal **power relations** and **management responsibilities** will lead to a better appreciation of the **constraints and opportunities** for decision-making and management and this leads to more 'meaningful strong science'. For example, identifying who has the ability to influence decisions, who makes decisions and who has right to tell who to do what, allows the presentation and deliberation of options for management to be 'intelligent' to the dynamics of the stakeholder group. A better understanding of the stakeholders and **their roles and functions** assists in the tailoring of presentational materials within the output step and thereby helps the team developing the presentation to take into account different ways in which stakeholders learn, absorb and translate information. Information on **institutional and development history** as well as the **management legacy** helps to avoid **inefficient use of resources** both in meetings and prior to the meetings discussing unfavourable options which may have already been rejected or failed in their implementation. In addition, it should also serve to assist in avoiding the **repetition of previous mistakes**.
Stakeholder mapping	
Role within the output step	At the stage of the Output step stakeholder mapping provides the basis of the **identification of participants** within the output step's stakeholder and deliberation forum. This should be used in conjunction with the institutional mapping and CATWOE/DPSIR to **understand fully those with stakes** within the coastal zone and to the relevant policy issue; gaining a deeper understanding of the **inter-relations** and **agendas of different** stakeholders and where conflicts are likely to exist. Without this, information the meetings are poorly informed

	and therefore less effective.
Value/Key advantages of including the tool.	Utilising tools which permit the **clear** and **early identification** of the broadest range of people will provide the best opportunity for the widest range of stakeholders to be represented, thereby increasing the **likelihood of effective feedback** on the research results (whether this is the broadest range of feedback or from the key stakeholders) and a **greatest legitimacy** of the outputs Similarly, using the tools to identify all those with relevant interests (and subsequent representation within the process) may lead to **decision-making occurring** and the **policy utilisation** of the research findings. Has the practical advantage of enabling the **targeting of presentations** to all stakeholders – and the identifying the need for more than one meeting if deemed necessary.
Selection of the Policy Issue	
Role within the output step	An understanding of how the policy issue was selected (in terms of both who was involved and how the selected issue interacts with other issues in the coastal zone) provides essential **background information for discussing the research outputs**. This will also return the discussion back to the original aims of the SAF and the ecological dysfunction of interest and therefore 'close the loop' and may enhance the transference of the project findings and recommendations into policy and action. Recognition of the **impact that the choice of the Policy Issue** has had upon the **modelling results**, especially in relation to the different ESE components that have been able to be modelled. The PI selected may mean that **different elements of the system may be emphasised** over others and therefore this needs to be understood when delivering the SAF output.
Value/Key advantages of including the tool.	Re-discussion of the PI (and its selection) should maximise engagement in the Output Step as it reinforces **the prior role of the stakeholders** in this selection and their **place as decision-makers** (assumes that they were effectively integrated at the beginning) thereby **reinforcing prior learning and prior engagement.** For those stakeholders who were not effectively integrated at the beginning or interested parties who have subsequently become involved, explaining the reasons for the selection of the PI (especially when the priorities may overlap with theirs) not only provides **essential background information**, but may be used to **attract interest and participation** within the output step – thereby **broadening engagement.** Reflection on the influence of the Policy Issue on the outcomes of the SAF provides both a **context**, and in some cases a **justification**, for the decisions made when modelling. **Explaining and justifying** the choice of the policy issue and its **boundaries** may help to manage the **expectations of stakeholders** about study outputs and decisions able to be made from these results.
Conceptual modelling	
Role within the output step	The conceptual model developed in the Design Step should provide a **clear structure** for the discussion of the results, scenarios and potential management interventions (e.g. scientists can use the conceptual model to illustrate those components which have been incorporated within the simulation model, those elements that are outside of it and how they interact). It can therefore be used to **structure the debate within the deliberation forum**. The model can serve as a **linking mechanism** between the beginning of the SAF process and the presentation of the outputs. In some instances scientists may have selected to refine their original conceptual models throughout the SPICOSA process and in particular on reaching the Output step. In these cases it is important that this **process of refinement is explained**, and where possible undertaken with the input of the stakeholders. A conceptual model is flexible enough to **identify the different scales** at which different

	elements of the system may function. This permits a discussion of these scales and their **influence alongside the model results.**
Value/Key advantages of including the tool.	If stakeholders were actively involved in the production and validation of the conceptual modelling then the use of the conceptual model may **legitimise the process as well as reinforcing prior learning.** The model should provide the **background information** for the introduction of different management options (e.g. what action is required; who needs to take these actions and what attitudes might need to alter in order to achieve these changes). Using the conceptual model that has been developed can clearly illustrate those actors, activities and environments that a decision may impact and any subsequent impacts, thereby **facilitating the selection of a management option**. The inclusion of scale is valuable to the Output step as for deliberation to be most effective and for management options to be adopted, the different **geographical and temporal scales of management need to be recognised.**
CATWOE/DPSIR	
Role within the output step	CATWOE enables a **better** understanding of different perceptions and different worldviews re-contextualising the engagement process in the Output Step This tool in particular focuses on those stakeholders who have **direct interaction with the system** and therefore on **affecting change**.
Value/Key advantages of including the tool.	Understanding the different subsections of opinions better both prior to and during a deliberation forum, may serve to highlight **potential opportunities for change or conflicts and enable a proactive response**. It is useful when **identifying the problem**, prompting thinking about what might be achieved and also when seeking to implement the solution, assisting consideration of the impacts on the people involved.

Table 2) Taking advantage of Issue Identification and Design Step tools