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ACRONYM: **S**cience and **P**olicy **I**ntegration for **Co**astal **S**ystem **A**ssessment

DELIVERABLE D1.8

Updates review of the Deliberation support tool and its use in coastal contexts

WORK PACKAGE: WP1 Policy Interface

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Description of D1.8:

This final report reflects more broadly on the use of the deliberation tool within SPICOSA and suggests that there is a gap between the post-normal science-policy interface setting anticipated by the Project and its participants (e.g. dialogic, inclusive, integrative), and that setting that emerged in practice. It argues that whilst the Project found significant success in nurturing a comprehensive understanding of the issues, and participants reported the post-normal science approach as holding significant promise, there were barriers to giving effect to this perspective. As such, study site respondents reported variable success in affecting coastal governance outcomes; influencing collective deliberation and decision-making between coastal stakeholders across multiple institutional settings. It then concludes adressing two emergent themes with regard to the use of the deliberation tool in coastal contexts. The first relates to the role of issues in structuring deliberative decision-making within coastal environments. The second emergent theme is that of scenarios and the discussion explores the nature of scenarios and the key questions involved in choosing the drivers used to formulate scenarios.

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Introduction : this text and its evolution

This SPICOSA deliverable was initially conceived as a procedural analysis of SPICOSA's Ker-DST deployment in SPICOSA's SSA. Nevertheless, through the course of SPICOSA it rapidly appeared that key challenges needed to be addressed before being able to formally test and reflect on the use of KerDST in a coastal context. This led for a need to develop an understanding of the linkages between the conceptual foundation of deliberative decision making within coastal areas, its concrete implementation and the potential outputs in terms of governance. We have thus decided for this report to take a reflexive distance from the tools itself in order to "review of the Deliberation support tool and its use in coastal contexts".

This reflexive distance has been deemed necessary in order to reflect on what should and could be done to insure that Ker DST is better used in coastal contexts for the future. This report is thus much more centred on ex-post empirical research than initially envisioned. The approach we have privileged in order to achieve this "review of the Deliberation support tool and its use in coastal contexts" is therefore to reframe SPICOSA within the common conceptual boundaries that the project as a whole shares with deliberative decision making and KerDST as a first step. These common conceptual boundaries lie within the field of post-normal science. The second step we undertook is an empirical analysis of SPICOSA's governance outcomes. From this framing and this analysis we could thus reflect on KerDST's use in a coastal context and reframe the procedural challenges that we had to face in the course of SPICOSA. Fundamentally, this deliverable must be seen as a reflexivity tool/ a guidance tool for future implementation of Ker DST in coastal contexts

We decided that this document should be usable on its own, we therefore took the liberty to present issues associated with ICZM science and policy integration, in a post normal science framing, and to present SPICOSA in such a framing as well. It is thus consciously that we took the risk of being a bit repetitious for reader familiar with ICZM or SPICOSA.

In a first part we will introduce the conceptual foundation of SPICOSA's Ker DST. We begin by presenting the dialogical foundation of knowledge use in coastal contexts. We carry on with e structuring of societal choices in a matrix format before presenting the conceptual specifications of Ker DST. We felt this section as critical in order to gain the necessary grounding, before taking a reflexive distance from the KerDST tool itself. In order to achieve this reflexive distance, we chose to evaluate governance outcomes, framed by our post-normal science argument. This approach allows for a better understanding of where key prerequisite of the deployment of deliberative decision making may have been challenging in the course of SPICOSA. This evaluation is the purpose of the second section.

In a second part, the evaluative part, we will begin by clarifying the relationship between Integrated Coastal Zone Management and post-normal approaches to science. This is a critical dimension of the use of deliberative decision making within a coastal context. We then proceed in this framing exercise with SPICOSA as a project. While this section may appear, for those familiar with SPICOSA, as a bit repetitious, we felt critical that this report could be geared at people unfamiliar with SPICOSA as well. We carry on by setting the context for the ex post analysis and evaluation of the Project in practice across four study sites, by establishing the conceptual framework and describing the method of analysis and evaluation. We then discuss the results of the research, before concluding on the degree to which SPICOSA did indeed emulate the attributes of 'post-normal science' in practice, and the effect that this approach had on Ker DST potential to contribute to coastal governance within the different contexts.

Finally, we conclude with some analysis of the use of KerDST in a coastal contexts. We focus on the deployment of KerDST dynamics in SPICOSA. The key elements in this analysis stem from the results of the second part of this report.

PART 1: Spicosa KerDST: deliberative decision making and science-policy integration.

SPICOSA-KerDSTs design had been based on the hypothesis that science and policy integration in the coastal areas called for deliberative decision making. The purpose of SPICOSA's ker-DST is to equip coastal communities with a Deliberation Support Tool that will facilitate the Dialogue Process of Science and Policy Integration in the Coastal Areas. We begin this section by reviewing some of the foundation of deliberative decision making before exposing how deliberation may be structured through the deliberation matrix framework.

Knowledge as a Dialogue Process

Despite the re-affirmation during the 1980s and 1990s of the 'liberal' model of economic progress based on entrepreneurial excellence and a large freedom for market-based activity, the vision of "what the future may hold in store" and the normative base for charting the future course of our societies, seems to have become less rather than more clear in recent years. The new era of 'globalisation' is greeted in Europe, as elsewhere, with some trepidation. Notwithstanding an opening up of new opportunities, the vulnerability of coastal economies and the ruptures with 'traditional' resources and transportation based activities weigh heavily in many people's hearts and minds. Our coastal zones are going through several simultaneous transitions whose consequences in technological, economic, lifestyle, political, moral and cultural terms are very much matters of open speculation. These include:

- The penetration of various forms of technologies having as objective the mastery of the coastal and marine realms (e.g., aquaculture, GPS);

- The rapid assimilation of the revolutionary possibilities of digital communications technologies in every walk of life (including coastal tourism marketing and coastal e-governance);

- The emergence of environmental performance and risk management considerations as a dimension of corporate action (technology choice, performance reporting, communications strategy), public policy, and citizens' action in every walk of life;

- The emergence of "new" coastal challenges such accelerated sea level rise, increased occurrence of extreme events, demographic transitions (be through the rise of retirement communities or the rise of alternate form of tourism) or real estate value;

- Reconfiguration of political and economic alliances leading to redefinition of commercial fluxes, key harbours and coastal industrial areas.

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. Within the context of Science and Policy integration for the coastal areas, the post-normal perspective on science and technology encourages us to adopt a dialogue model of knowledge (O'Connor 1999). But, an 'epistemology of dialogue' has many facets. Different components of social science evoke a spectrum of social and institutional dimensions including the pertinence of multi-stakeholder dialogue, of "concertative" governance, of political models of deliberative democracy, of hermeneutic traditions, of ethno-methodology, grounded theory and other framings of applied interpretative sociology. Common to all these is the notion of a 'dialogue' that can be proposed — and deliberatively (sic) constructed — between the disparate components of society, including dialogues between different perspectives on science and on the science-policy interface, between different social science models and perspectives of governance, between different models and theories of democracy, of legitimacy, of justice and justification (and so on, and so on).

Two themes are fundamental for this dialogue model of knowledge. First, under conditions of 'imperfection of knowledge', it is not necessarily presumed that disciplinary sciences advance towards a full unity of knowledge. This 'full unity' is infinitely removed from our sight (and, for all we know, it may never exist). What we are left with is the perspective of mobilising incomplete knowledge and exploring considerations of pertinence of knowledge as a function of context (see inset box). Accepting this standpoint means reappraising the role and status of science as a help for navigating in complexity. Not only is knowledge always 'incomplete' in ways that can pose real practical dilemmas, but also there can, at any time, be an irreducible and legitimate plurality of theoretical perspectives and frameworks of analysis. This seems true for the natural science of complex systems and, even more so, for the conditions of social life and, a fortiori, for the social sciences. So the theme of dialogue is particularly pertinent for the interdisciplinary domain of policy science at the crossroads of complex systems sciences and the social sciences.

Second, knowledge in the sense of inter-subjective understanding and meaningful relations is fundamentally to be distinguished from the sort of knowledge obtainable uniquely through measurement of objects and physical processes and the scientific prolongations such as modelling based on logics of deductive explanation or geared to prediction. Two irreducible dimensions along the plane of social science knowledge are (1) the need to interpret social events and their significance, and (2) the prospect and desire for this knowledge to be expressed socially, that is, shared and communicated. Moreover, the structures of meaning, symbolic reference and so on are 'cultural' forms that are largely

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pre-existent for each individual and which 'condition' and permanently socialise the individual just as much as the physical circumstances of life (Castoriadis, 1975).

These points of epistemology help to illuminate the hopes placed in "stakeholder dialogue" and deliberation as means to simultaneously attain Integrated Coastal Zone Management and Science and Policy Integration. One of the central tenets of "deliberative democracy" as a model for coastal zone governance is that socially robust and legitimate decisions on complex subjects cannot rely on elites or on professional expertise alone; there also needs to be the expression of the wider "social demand" through the integration of a broad spectrum of society's stakeholders. Many distinct principles, justifications and ethics about what is fair and right, can and will be put up for consideration. Evaluation of choices will be framed within a social-political process where conflicts emerge and must be resolved between competing interests, between people holding different value systems and different principles of judgement and also between different representations of future states and different visions of the world. The challenge then is to work with a permanent exchange, argumentation and sometimes compromise between different principles of choice. In some cases, established political authorities and influential economic lobbies may aggressively sideline dissent. In other cases, matters of controversy will be admitted deliberately into political process and the debate is thus made "legitimate".

This perspective on governance and political process carries with it the requirement for building our capacities — and the habits and willingness — for reciprocal learning and understanding and for "understanding of difference". Hence, for "bridging the communication gaps" between sectors in coastal areas who, for whatever reason, do not readily comprehend each other. Yet, the "deliberative" ideal is one that can be given only incomplete effect in different levels of policy, planning and decision-making. Sometimes different groups of people simply cannot, or do not want to agree. Looking around us in the world, prospects of reconciliation — between present and future generations, between different human societies today, between human and non-human communities, and so on — are often rather dim. Nonetheless, the premise of deliberative democracy is that something more than a "zero-sum" compromise between fixed positions is possible. By exposing participants' initial views to one another and to reasoned debate, they may change, and in this way — sometimes — be brought together or permit new coexistence prospects to emerge.

Of course, it is also conceivable that the dialogue attempts may fail. In the turbulence of human societies, domains of common ground are like patches of blue in a stormy sky. Deliberation processes may, in some cases, work to clarify tensions and contradictions amongst stakeholders without resolving them. These limits should not be discounted. What the deliberative model highlights is that knowledge and reasoning in society is not only about outcomes, it is also (and perhaps above all) about meanings

and relations. Decisions are judged to be good (and outcomes acceptable, or not, etc.) partly as a function of the relationships that are established and maintained between those concerned. This explains why attention to the inter-subjective dimension is not a sociological luxury, it is essential for viable policymaking.

This also helps explain why the 'knowledge base' for sustainability strategies must extend to "mundane knowledge" and to the subjective and inter-subjective (as well as economic and institutional) conditions for mobilising know-how in everyday contexts. Each person, each social group, each 'class', each stakeholder category (etc.), each culture or 'people' has — to some degree — a unique history and a culturally rooted collective consciousness. The specificity of this consciousness has, as its corollary, an inevitability of ignorance, misunderstanding and incompleteness of knowledge of others' consciousnesses. (The well-known difficulties of cross-class or cross-cultural dialogue relate to this.) At the same time, one can become acquainted with non-lived experience on the basis of being in dialogue with others. Our common sense experience is that such dialoguing can indeed take place. But, it does not lead to a single whole and seamless knowledge. As Latouche (1984) insists, the enduring diversity of opinions and knowledge claims stands out as an indisputable social fact!

We may therefore put forward our theme of "building knowledge partnerships for sustainable development" in a paradoxical manner: first of all acknowledging the "gaps" in order better to seek ways of "bridging the gaps" that often are glaringly visible in science-policy-society domains. Anil Gupta (1999), for example, highlights a range of institutional and psychological 'barriers' that can exist to effective communication and sharing of knowledge. Among others, we may mention the following:

- Obstacles to linking "little science" and public policy: Professional scientists often do not adequately recognize and reciprocate the informal scientific knowledge, creativity and innovation at grassroots level in coastal communities (be it fishermen's knowledge on the fisheries, or the laypersons understanding of real estate dynamics). The science underlying the successful overcoming of some of the day to day struggles of coastal economic or social actors does not always get articulated or acknowledged. This "gap" between informal competence and formal policy-science domains means that "little science" does not influence the public policy agenda as much as it could.

- Tension between standardised knowledge and diversified need: A second gap between coastal civil society and policy makers is in the field of technology and scientific knowledge, and policy support for improving livelihood strategies of coastal dwellers. For a large number of people living in the high-risk environments such as flood prone regions, economically dependant

harbours, etc., there is not much practical scientific knowledge available that can improve their livelihoods. The question of communication to policy makers does not even arise. And where such knowledge does exist, the barriers are very strong because of bureaucratic needs often to generate standardized solutions in the context of the underlying ecological and social heterogeneity in the region. Organizational incentives for generating technologies with limited potential for diffusion are very low.

- Barriers to blending excellence in formal and informal sector: Policy makers and resource managers sometimes evolve filters and structural barriers that prevent them from recognizing the potential that exists for blending formal and informal science. This can easily occur in international cooperation situations. Thus, while providing funds or other support, the agencies do not strongly enough insist that (a) such bridges be built and accordingly, (b) faster progress in sustainable development of people's potential and resource capabilities takes place.

Sustainability policy design and implementation must, correspondingly, be based on skill at interpreting a multiplicity of life worlds. As proposed by Norgaard (1988):

"... the policy process will enter the realm of the hermeneutic where there is no prior agreement on the key questions, appropriate framework or essential facts. With an expansion of worldviews and a broader conception of knowledge, we will find little consensus on questions, methodologies and data for determining optima. Good policymakers will be those who can lead enlightening conversations between scientists with different disciplinary backgrounds and between people of different cultures and knowledges."

The purpose of SPICOSA's ker-DST is to equip coastal communities with a Deliberation Support Tool that will facilitate the Dialogue Process of Science and Policy Integration in the Coastal Areas. The design concepts of this tools follows.

Societal Choices in the "Deliberation Matrix" Framework

Framed in terms of economic analysis, sustainability is a problem of social choice, and many argue that coastal sustainability is the archetype of problems of social choices. A variety of technological and resource considerations may determine whether or not a coastal economy is capable of following a sustainable development time-path. But the society "chooses" its course, for or against different considerations of sustainability, within the limits of what is possible. In a simplified way:

On the supply side, the task is to define the frontiers of what is feasible for the coastal economy and environment.

On the demand side, the task is to assess what members of the society might judge desirable.

Traditional concerns with productive efficiency, resource discovery and technological progress have put the emphasis on pushing out the frontier of possibilities over time. But, the emergence of concerns for (1) the "ecological limits" to expansion of economic production and (2) the adverse side-effects and "environmental costs" associated with coastal economic expansion, changes the profile of the social choice question. The focus now is on the generation and distribution not just of wealth but also of anti-wealth — that is, the production of dangers, damages and of "risks" (prospects of future penury, difficulties and damages) that may fall on others elsewhere or in future generations.

Provision for the "needs of future generations", as for all other forms of diversity, can be assured only through choices of resource use (investment and protection decisions) whose intent is to enhance the opportunities and environmental security of the "others". The associated challenges for knowledge and its mobilisation are complex because, at root, the challenge of a sustainable development is not a problem of efficiency; it is a problem of collective purpose, norms, vision and social choice.

In sustainability, as in all innovation and risk management policy contexts, there is usually a need to identify, appraise and choose amongst the various different options or courses of action that present themselves. Economics analysis develops evaluation methods in terms of the comparison of one thing or action with another. If an action A is contemplated, the questions may be asked: What is gained by action A? What is lost or excluded by choosing A rather than B (or 'not-A'). Economists therefore speak of the 'opportunity costs' of an action, this being defined as the value of the most attractive alternative foregone. A standard approach to decision support is then to seek to establish a 'rational' justification for a choice between A, B, C, etc., on the basis of relations of preference. If C is preferred over B, and B is preferred over A (etc.), then C is the highest-valued action.

	A	*B*	*C*
Alpha	GOOD	VERY BAD	MEDIOCRE
Beta	MEDIOCRE	GOOD	VERY BAD
Gamma	VERY BAD	MEDIOCRE	GOOD

However, this simple principle of establishing preferences, or a ranking of options, is not always easy to apply and does not necessarily resolve a problem of choice. The primary reason, which is relevant for almost all policy problems, is that whenever choices (A or B or C, etc.) involve or will have consequences for more than one person, judgements may differ as to what is preferable. Typically, the different options (A, B, C) will produce differing distributions of benefits and costs for the individuals or sectors of society concerned. We can illustrate this with the notion of a 'conflict matrix'. Suppose that each of three sectors of a society, Alpha, Beta and Gamma, put forward their preferred policy, A, B and

C respectively. We might obtain a profile of judgements as in the table, where no overall ranking emerges.

This illustrates the formal 'problem of social choice'. One man's meat is another man's poison, and so selecting between the three options requires some sort of 'arbitrage' or ruling over the appropriate distribution of (perceived) benefits, in other words a problem of fairness, justice, equity. The distinctive sectors or 'stakeholder' groups will not necessarily agree about what is 'best'. And, not only will the different protagonists concerned have divergent views about what is their interest, their right or their due; they may also propose quite different principles for resolving this problem of social choice.

The difficulties of this formal "problem of social choice" are reinforced by a variety of considerations that include:

- Choices usually relate to complex entities, processes or outcomes, each option (A, B, C, etc.) being characterised by a range of attributes. Comparison of options means comparing a vector of attributes with a variety of concepts, units of measure and criteria. It is not always easy to pass from a multiple criteria appraisal to a ranking of alternatives along a single scale.

- Consequences of choices are distributed in time and, often, different aspects of outcomes (good and bad, as perceived by different constituencies) will have distinctive time profiles, e.g., fish population dynamics, dilution of pollution by natural processes, coastal erosion.

- For all actions whose consequences will be revealed through time, there are various degrees of uncertainty due partly to natural system complexity and partly to 'social' indeterminacies such as other decisions not yet made or whose consequences are not yet known.

- A great variety of different reasons or principles can be put forward as justifications for the acceptability, or not, of different outcomes (including perceived uncertainties and risks, distribution of benefits and costs across different constituencies within society, or across generations through time, etc.). It may not be possible to respect all principles simultaneously (this may be the case for the judgements offered by a single person, or for the judgements offered by a range of sectors). Because the principles may be 'irreducible' (that is, incomparable, in the sense of being grounded in qualitatively different considerations), choice can be characterised by dilemmas and the need to yield ground or make sacrifices of principle, rather than mere trade-offs on quantitative terms.

The significance for the evaluation/social choice problem of a plurality of justification principles considered as irreducible, can be illustrated by a second 'conflict matrix' (below).

In this complex governance context, a pragmatic evaluation approach is to frame the problem of 'social choice' as a multi-stakeholder deliberation about the merits and

	Option A	Option B	Option C
Principle 1	Not Applicable	SATISFACTORY	INACCEPTABLE
Principle 2	SATISFACTORY	INACCEPTABLE	Not Applicable
Principle 3	INACCEPTABLE	Not Applicable	SATISFACTORY

demerits of policy alternatives that present themselves to the society. This establishes, from starting points within economic analysis, the requirements for a dialogue model of knowledge as an underpinning for social choice in conditions of complexity. This dialogue process of knowledge will, in the context of SPICOSA, be operationalized by the on-line SPICOSA-KerDST (Deliberation Support Tool) developed by the KerBabel™ team at the C3ED. This system is centred on the "Deliberation Matrix" as a framework for collaborative learning, supported by an "Indicator Kiosk."

The comparison of policy options (or management regimes, or investment programmes, etc.) is organised as a deliberation process, in terms of:

- A small number of alternative scenarios (envisaging various 'possible futures');

- A defined spectrum of governance issues (covering economic, environmental and social aspects) addressed in terms of multiple criteria of performance, quality, etc.;

- A synthetic representation of the full spectrum of the 'stakeholders' in the policy process.

- The 'crossing' of these three dimensions leads to the three–dimensional Deliberation Matrix (or "Cube"), which in effect can be seen as the combination of the two above-mentioned conflict matrices (discussed in the next section. The role of the Deliberation Matrix is to permit a transparent presentation of the process and outcomes of judgements offered by each category of stakeholders, for each of a variety of scenarios, across a spectrum of governance or performance issues.

Social choice or policy evaluation work proceeds, as we have said, by valuing two or more alternatives relative to each other (the simplest is 'Do policy A' compared with 'Do nothing in particular'). In our multi-stakeholder deliberation context, the role of scenario development is the construction of a set of exploratory views of the future — the 'space of opportunity' as a set of several scenario images— that acts as a support allowing stakeholders to discuss and appraise the relevant action, policy, decision or governance issues. The evaluation of scenarios — or of options for action — takes place from many different points of view. As the multiple perspectives are brought to bear on a common ground (the scenario set) then the tensions, conflicts of interests, uncertainties and dissent (amongst scientists as

well as decision makers, administrators and stakeholders from different walks of commercial activity and civil society) can be expressed and explored in a structured way.

The evaluation process is not purely analytical. Rather, it is a social process with strong interactive and inter-subjective dimensions, which open up the possibility of 'emergent' properties. By proceeding through the steps of choosing indicators cell-by-cell, the group members may be drawn into discussing the relative merits and demerits of the different scenarios, of the different indicators, of the different methods for arriving at a synthetic judgement, and so on. Beyond that, the vision of collaborative learning through participation in a 'social choice game' is based on the hypothesis that individual reflection and/or exchanges of views between protagonists in a deliberation/negotiation process may lead to modifications at any or all or the steps of the choices and judgements leading up to an entry in a cell of the Matrix table. Group members 'representing' stakeholders of one type may also try to persuade stakeholders of another type to modify their criteria or relative weighting; and so on.

In sum, the structuring of a formal multiple stakeholder, multiple criteria policy scenario evaluation process in this way, presents the following advantages:

- It permits the transparent organisation and mobilisation of a variety of categories of information and analysis (from diverse sources), with explicit reference to the social choice or governance issues;

- It presents in a didactic and transparent way, the central challenge of an open political process, which is to negotiate some sort of 'compromise' around conflicting interests and with recognition of a plurality of legitimate principles for choice;

- It facilitates, through the mobilisation of stakeholders in different components of the deliberation process, the development of a dialogue capacity between the different classes of knowledge producers (both 'formal' and 'informal') associated with the management problem and also between knowledge producers and the different classes of 'users' of knowledge in the society

- It provides a framework for a structured discussion and evaluation of the significance, for the policy or governance issues being addressed, of the different forms of uncertainty that may be associated with the various classes of empirical information, modelling and simulation results being introduced into the deliberation.

The SPICOSA - KerBabel Deliberation Matrices

In this section we will show how the structuring of multi-stakeholder dialogue and deliberative approaches to Sustainability Assessments can be implemented with the aid of interactive ICT "deliberation support tools". Our focus here is on the use of the SPICOSA KerBabel™ Deliberation Matrix with its associated SPICOSA KerBabel™ Indicator Kiosk (KIK) developed at the C3ED.
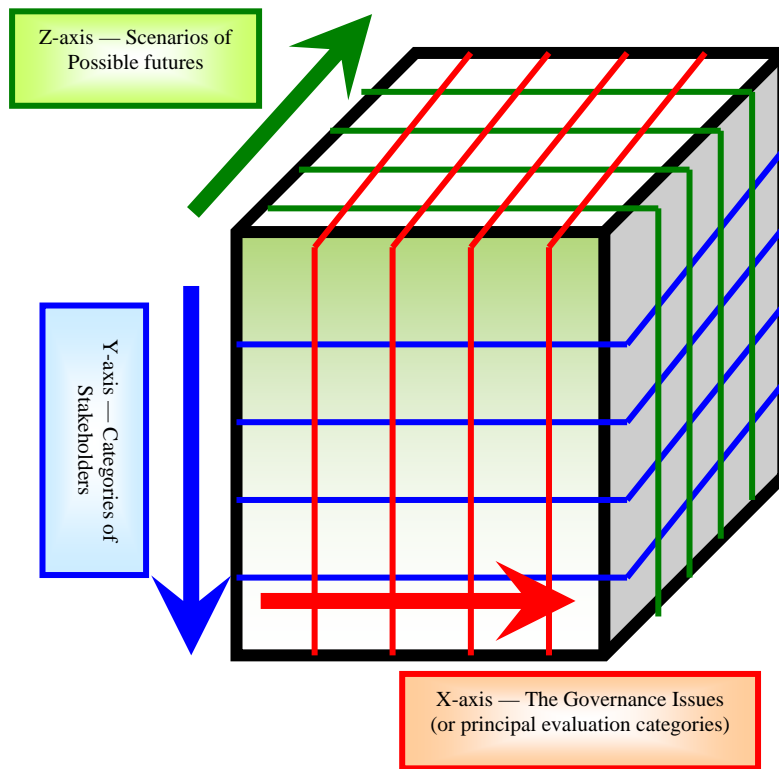
We have proposed that Sustainability Assessments can in general be organised as a multi-stakeholder multi-criteria deliberation process, structured in terms of:

- A defined spectrum of performance "bottom lines" to be addressed; and

- A synthetic representation of the full spectrum of the 'stakeholders in sustainability' relevant to the assessment situation.

- Starting with this basic structure as a function of the class of situation — e.g., company performance appraisal, evaluation of territorial planning options or investment programmes — we introduce further comparative dimensions as a function of evaluation need. For example:

- In the case of ex ante evaluations of policy or investment alternatives (at whatever scale of system being considered) one might propose a number of alternative scenarios (that is, envisaging various 'possible futures').

- In the case of ex post evaluations, one might wish to consider, in a comparative appraisal, a spectrum of industrial sites/plants, or a number of distinct territories (cities, regions, catchments, etc.), or different countries; and so on.

The 'crossing' of these three dimensions leads to the three–dimensional structure of the KerBabel™ Deliberation Matrix (see O'Connor 2006c).

The role of the Deliberation Matrix (henceforth DM for short) is to permit a transparent presentation of the process and outcomes of judgements offered by each category of stakeholders, for each of the scenarios, across a spectrum of governance or performance issues.

In this process, the range of options (along the Z-axis), of governance issues (X-axis) and of stakeholder categories (Y-axis) must be established. This can be done either on the basis of prior discussions and analyses, or by real-time deliberation amongst those participating in the SA. As will be seen, the on-line kerDST system permits both of these procedures.

Z-axis — Scenarios of Possible futures

Y-axis — Categories of Stakeholders

X-axis — The Governance Issues (or principal evaluation categories)

According to this schematic model, the evaluation activity proceeds through a step-by-step phase — which can be undertaken on an individual or a collective basis within a group — that consists of colouring the cells of the 3-D Deliberation Matrix. Once the DM structure is in place, or even as it is being developed, the actors in the SA process focus on each cell of the DM, with the purpose that each stakeholder class should offer a judgement (e.g., satisfactory, poor, intolerable, etc.) of each scenario in relation to each of the key governance or decision issues.

- One obtains in this way, for each stakeholder (or class of actors), a rectangular array of cells, being a layer of the Matrix, within which the successive rows represent the evaluations (issue by issue) furnished by the selected class of stakeholders for successive scenarios.

- And, looked at from another angle, one obtains, for each scenario, a rectangular array of cells, being a layer of the Matrix, within which the successive rows represent the evaluations (issue by issue) by each class of stakeholder, of a given scenario.

- And, in the third way of "cutting the cake", one obtains for each issue (or SQPMBLs), a rectangular array of cells, being a layer of the Matrix, within which the successive rows represent the evaluations (stakeholder by stakeholder) of each scenario, with reference to the selected issue.

KERDST Typology of Deliberation Processes with the "KERDST" Deliberation Support Tool © KerBabel™ C3ED (2006)		ROLE OF INDICATORS IN THE EVALUATION	
		NO INDICATORS "Colouring in the cells" (with or without commentary) *For each cell, a single judgement (by colour) is registered for each stakeholder category (via discussion or expertise)*	WITH INDICATORS The judgement for each cell of the Matrix is informed by a "Basket of Indicators". *The colour of the cell depends on the signification and relative weighting attributed to each indicator in the 'basket'*
USER COMMUNITY	CLOSED The deliberation is not open to an extended community *A single (synthetic) judgement is registered for each actor/stakeholder category*	QUALITATIVE MULTI-STAKEHOLDER MULTI-CRITERIA ASSESSMENT	NON-PARTICIPATORY INDICATOR-BASED ASSESSMENT
	OPEN An extended user community *Multiple participants within each stakeholder category may contribute to the evaluation.*	QUALITATIVE MULTI-ACTOR PARTICIPATORY ASSESSMENT (WITHOUT INDICATORS)	MULTI-ACTOR PARTICIPATORY INDICATOR-BASED ASSESSMENT

PART II: The science-policy interface for coastal governance, the deliberation tool and the postnormal perspective – governance based evaluation

Integrated Coastal Zone Management (ICZM) represents more than four decades of evolving theory and practice on the best means for framing society's collective deliberation and decision-making for the coastal commons. To this end, ICZM has from its inception had a strong emphasis on supporting decisions with comprehensive coastal science, communicated across an interdisciplinary science-policy interface. Since 2000 however, ICZM has been increasingly characterised by concepts of ecosystem-management and governance, with implications for the science-policy interface. The former introduces the coastal 'system-to-be-governed' as containing significant complexity, interconnectivity, adaptability and uncertainty; the latter views society's response in terms of an equally complex and adaptable 'governing system' (see e.g. Jentoft and Chuenpagdee (2007; 2009), and Glavovic (2008)). This is 'governance' beyond government, admitting a diversity of coastal stakeholders interacting with the coast and each other across multiple institutional settings, as distinguishable from technocratic science-based 'management.' A realisation of the complex mix of science and politics within the coastal science-policy interface has led authors to increasingly describe the interface in terms of a governance setting. In this way, scientists are brought into the complex and dynamic network of stakeholders, rather than remaining neutral and disinterested advisors. Scientific advice is communicated in terms of the political interactions that characterise coastal governance, constituting the co-construction of knowledge and values through political interaction (Fritz, 2010; Knol, 2010).

In recognition of the science-policy interface setting within a coastal governing system, a number of authors have suggested principles for the creation of a more participatory and deliberative setting. Such a setting should, according to authors like Cicin-Sain and Knecht (1998), Boesh (1999), Fritz (2010), Knol (2010), Tobey and Volk (2002): (i) embrace a 'dialogic epistemology,' where knowledge is mobilised through dialogue; (ii) be 'inclusive' of a diversity of perspectives, beyond science; (iii) 'integrate' or bring together diverse perspectives through principles of reciprocity and co-existence; and (iv) ensure the 'quality' of knowledge for deliberation and decision-making, according to measures of credibility, salience and legitimacy for instance. A number of different epistemological perspectives have been put forward to give effect to these principles within ICZM, ranging from Lee's 'civic science' (Glavovic, 2008) to Gibbon's 'mode 2' science (Knol, 2010), to 'transdisciplinarity' (Boesch, 1999) to Funtowicz and Ravetz's 'post-normal science' (Costanza, 1999; Kendra, 1997). However while theories

abound, there is a paucity of ICZM practical experience of giving effect to these epistemological approaches. This represents a significant short-coming in a reflexive field such as ICZM, where theory and practice are so tightly woven. A key hypothesis therefore is that in SPICOSA the innovating nature of focusing on deliberative approaches, facilitated by the use of KerDST may have been underestimated and therefore taken for granted.

At its inception we felt that SPICOSA represented a concerted attempt at <u>applying</u> a new epistemological approach to framing the science-policy interface for ICZM. Based in a dialogic epistemology, which icon lies in the use of the Ker DST, the SPICOSA Project set out to give effect to principles of 'inclusiveness,' 'integration' and 'knowledge quality;' and in so doing developed an approach which this article describes in terms of a 'post-normal science' epistemological perspective. Such an approach holds significant promise for a science-policy interface described in terms of governance, however post-normal science has rarely found explicit expression within ICZM initiatives; highlighting the novelty of SPICOSA for the practice and theory of ICZM. The SPICOSA Project therefore offers a significant opportunity for inductive research that explores the way in which the innovative post-normal science approach, and one of its "practical" manifestation, Ker DST, influences the science-policy interface setting, and by extension, influences coastal governance according to principles of ICZM. We decided therefore in early 2010, to conduct an analysis which sought to (a) analyse the implementation of SPICOSA within a subset of case studies, through the lens of post-normal science; before (b) evaluating SPICOSA's effect on coastal governance using indicators of quality ICZM outcomes. The research is thus steered by the following research question:

What is the effect of the SPICOSA Project, and its 'post-normal' framing, through Ker-DST, of the science-policy interface, on coastal governance according to the principles of ICZM?

Section 2 of this report begins by describing the SPICOSA Project according to its founding documents, which detail the Projects objectives for shaping the science-policy interface for ICZM, and the means that it proposes for achieving these objectives. The focus is therefore on the anticipated (*ex ante*) methods, tools and outcomes of SPICOSA, which this report characterises in terms of post-normal science. Section 3 then

Introducing SPICOSA as a novel 'post-normal' framing of the science-policy interface

Science and Policy Integration for Coastal System Assessment: The SPICOSA Project[1]

The SPICOSA Project is a European Union (EU) 'Integrated Project' which began in February 2007, and has been commissioned for a duration of four years under the '6th Framework Programme,' call of Priority 1.1.6.3 'Environment and Global Change.' According to the Project's 'Description of Work' document, "The overall objective of SPICOSA is to develop a self-evolving, holistic research approach for *integrated assessment* of coastal systems, such that the *best available scientific knowledge can be mobilised to support deliberative and decision-making processes* aimed at improving the *sustainability* of coastal systems by implementing *Integrated Coastal Zone Management (ICZM) policies*" (SPICOSA Project, 2010, p. 5, emphasis added). In giving effect to 'integrated assessment'[2] SPICOSA aims to bring together the knowledge and experience of participants from 54 partner institutes across 22 countries, and a critical mass of researchers, stakeholders and coastal managers, to affect change in the research and practice of ICZM throughout Europe. With a focus on the science-policy interface, SPICOSA's focus is on the setting where, (a) science integration, and (b) science-policy integration, requires the structuring of knowledge according to linked 'ecological-social-economic systems,' to effectively support decision-making as formulated under the European ICZM principles, and other EU policies (IFREMER, 2010).

The Project's organisation is strongly focussed on its central objective of the development, testing and refinement of a portfolio of Deliberation Support Tools (DST), Decision Support Systems (DSS), and supporting information, for use in support of ICZM around Europe (SPICOSA Project, 2010). The intention is that SPICOSA's tools will (a) mobilise the <u>best quality</u> knowledge available for a given issue; and (b) have long-term and general applicability within diverse coastal contexts across Europe, beyond the lifetime of the Project. As such, the SPICOSA tools are currently being tested in eighteen diverse

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[1] Those familiar with the SPICOSA project may prefer to skip this section.

[2] 'Integrated Assessment' has been variously defined, however below are two useful definitions; the first from Rotmans and Dowlatabadi (1997), and the second from van der Sluijs (2002):

(1) 'Interdisciplinary process of combining, interpreting and communicating knowledge from diverse scientific disciplines in such a way that the whole cause–effect chain of a problem can be evaluated from a synoptic perspective with two characteristics: (i) it should have added value compared to single disciplinary assessment; and (ii) it should provide useful information to decision-makers.'

(2) 'Integrated assessment is a reflective and iterative participatory process that links knowledge (science) and action (policy) regarding complex global change issues.'

coastal 'Study Site Applications' across the European region, which range from Norway to Portugal to Turkey. At each site, the intention is to implement the tools for the specific issues and policy questions of local stakeholders, with explicit recognition of the plurality of different perspectives and uncertainties that constitute these contexts. In addressing this complexity and uncertainty, the tools are being designed to be used at multiple different scales, and accommodate multiple knowledge systems. The development of the portfolio thus represents a practical combination of experience and theory; applied and evaluated in an iterative, manner such that all of SPICOSA's outputs aim to be well validated, and ensuring the participants will have the opportunity to learn and grow along with the tools and methods, with the intention of building capacity for ICZM in Europe.

The Systems Approach Framework (SAF) is SPICOSA's Decision Support System (DSS), and represents the central focus of the Project. It is dedicated to structuring knowledge (primarily science) for <u>integrated and participatory assessment</u> of policy issues in coastal zones (SPICOSA Project, 2010). Based on a complex and nonlinear approach to systems, the SAF is a multidisciplinary framework designed to describe the ecological, social and economic systems on the coast, and the interactions between these systems at different scales. Beyond description, the SAF is being developed to explore the dynamics of coastal systems, through the formulation of computer-based simulation models used to explore alternative scenarios in relation to a specific policy issue. Essential to this is the demonstration of the cause-effect feedback loop associated with coastal issues (the 'Coastal Zone Feedback Loop'); similar to the Driving Force-Pressure-State-Impact-Response (DPSIR) framework for instance. Given SPICOSA's policy focus, the iterative process of developing the SAF aims to allow for continuous input from stakeholders within the policy sphere, who are to help in the design, formulation and appraisal of the SAF model. Within SPICOSA, the SAF process is to both begin and end with explicit interaction with the policy sphere (see Figure 1), with Study Sites to employ an external 'Policy-Stakeholder Participant Group' to facilitate ongoing participation. The focus of the SAF is not to collect new knowledge, but to better mobilise, structure and communicate existing knowledge.

SPICOSA's focus on the integrated assessment of the coast is not limited to the integration of science in investigating the structures and dynamics of coastal systems, it also seeks to question the place of scientific knowledge and scientific actors in the governance of the coast. By viewing society's interaction with the coastline through a 'governance' lens, SPICOSA admits a multitude of institutional settings which simultaneously frame the interactions of coastal stakeholders with each other and the natural environment (SPICOSA Project, May 2010). Coastal governance becomes the totality of society's efforts across these institutions, with ICZM initiatives and processes demanding integration and coordination across institutions such that society can collectively arrive at a 'social choice' on the

future of the coast; including 'sustainable' trade-offs between social, economic and environmental priorities. Within the context of society's multi-faceted deliberation, SPICOSA locates itself as an initiative for bridging the science and policy institutional settings; in short, the 'science-policy interface.'
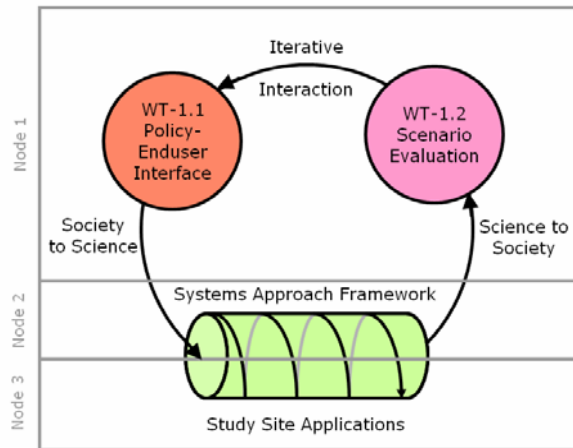

Figure 1: Demonstrating the interaction between the Systems Approach Framework DSS (within the science sphere) and deliberation within the policy sphere, via SPICOSA Deliberation Support Tools (taken from SPICOSA (May 2010))

SPICOSA aims to contribute to a more deliberative and participatory science-policy interface by developing and testing Deliberation Support Tools (DST) for the mobilisation of knowledge, particularly from the SAF, in support of deliberation between the full range of coastal stakeholders (IFREMER, 2010). In order to set the context for deliberation, SPICOSA proposes a *'Stakeholder-Policy Mapping'* DST (WT 1.1 – see Figure 1) with two functions. Firstly it is to aid in the identification of all stakeholders relevant to an issue, and set the basis for the creation of a participatory and deliberative science-policy interface forum. Secondly, by drawing out the diverse perspectives of stakeholders, it is to enable a multidimensional mapping of policy issues and human activities within a coastal context, possible scenarios and policy options, and establishes the terms in which progress of policy in resolving problems may be perceived and judged. Specific to SPICOSA, this DST is to provide data on social systems for the SAF, provide for the incorporation of alternative forms of knowledge alongside the science-centric SAF, and identify key holes in the knowledge. A second DST is designed to provide a conduit for the SAF results and other knowledge, to be appropriated within deliberations in the policy sphere; via the multi-media-based *'Deliberation Matrix'* (WT 1.2 – see Figure 1). 'The Matrix' is intended to structure dialogue within a science-policy interface forum such that knowledge, primarily from the SAF, can (a) be mobilised as 'evidence;' and (b) evaluated for its quality in supporting decision-making for a specific issue.

The above discussion of the SPICOSA project can be distilled within its six objectives, summarised below (SPICOSA Project, 2010):

1. Create an operational Systems Approach Framework (SAF) for coastal policy assessment;

2. Improve the science-policy interface through the quantification of complex systems;

3. Test the SAF by implementing at various Study Site Applications, to test its generic applicability;

4. Generate a SAF portfolio, consisting of generic Decision Support Systems and Deliberation Support Tools that are user-friendly and updateable.

5. Improve the communication and integration among coastal stakeholders.

6. Generate new opportunities for academic and professional training in ICZM.

It is possible to differentiate between three broad types of objectives within SPICOSA, though they are not explicitly divided as such in the SPICOSA Project, nor are they mutually exclusive. First and foremost, there are the objectives surrounding the development, testing and refinement of the SAF and it's supporting DST, as the 'outputs' of the SPICOSA project. These are the tangible products represented in Objectives (1), (3) and (4) above, which SPICOSA makes very clear are the central focuses of the project. Secondly there are the coastal governance 'outcomes' objectives, which are anticipated to result from the exercise of the SPICOSA tools and which will primarily be felt within the study sites, but perhaps also across Europe generally given the size of the project and the 'critical mass' of participants. To use interactive governance terminology (Kooiman, 2003), these outcomes can be defined both in terms of: (a) the effect on the quality of institutions, such as the science-policy interface, as represented by Objective (2) above; and (b) the effect on the quality of interactions among coastal stakeholders within and across these institutions, as represented by Objective (5) above. Thirdly, there are the 'learning' objectives, representing the increased learning and experience gained through the interactive development and implementation of the SPICOSA tools. This learning can be expressed both formally through the preparation of ICZM training programmes and resources, or informally through the 'social learning' that occurs where participants change their ideas, actions and attitudes as a result of working in groups for SPICOSA. Informal concepts of social learning implicitly traverse all of the objectives above, while formal learning is represented explicitly in Objective (6).

SPICOSA's 'post-normal' structuring of the science-policy interface for ICZM

As noted, the SPICOSA Project embodies an evolution in the practice and scholarship of ICZM, which has seen an increasing tendency to a participatory and deliberative science-policy interface, as viewed

through a 'governance' lens. Beyond the scholarship of ICZM, SPICOSA is influenced by a wide range of theories and approaches from across a diverse literature, though appears to find its most explicit theoretical basis in the literature on complex systems theory, and the way it can be utilised to (a) integrate across disciplines through multi-disciplinarity; and (b) integrate across the science-policy interface (SPICOSA Project, 2010). This theoretical basis finds expression in the more applied literature on 'Integrated Assessment,' which SPICOSA seeks to apply within the context of ICZM. That noted, it is the contention of this report that the specific science-policy interface setting proposed by SPICOSA can equally well be described in terms of the epistemological perspective of 'post-normal science.'

Post-normal science (PNS), as first proposed by Funtowicz and Ravetz in the early 1990's (1990; 1993), was put forward as an alternative to the 'modernist' model of resource management, with its 'normal' science-based[3] policy that they critically argued to be inadequate for addressing issues defined by their uncertainty, plurality of values, and high stakes. PNS on the other hand, is more sympathetic to notions of governance (De Marchi & Ravetz, 1999) by reframing the science-policy interface in terms of reciprocal dialogue across all classes of stakeholders, to mobilise the best quality knowledge possible in support of decision-making for a specific issue (O'Connor, 1999). A 'post-normal' science-policy interface is therefore a participatory setting that admits all forms of knowledge as evidence in support of a plurality of normative or value-based arguments. PNS observes that for highly contentious and politicised issues, the traditional domination of 'hard' facts over 'soft' values has been inverted; 'hard' value commitments may need to be made based on 'soft' facts (Funtowicz & Ravetz, 1993). That noted, it remains a robust setting, conforming to the idea of scientific thinking espoused in the Declaration of Science of the World Conference (International Council of Scientific Unions, September 1999).

Beginning from a complex social-ecological systems perspective, and a 'post-modern' recognition of society's diversity, PNS recognises the inevitability of both (a) holes in society's knowledge (ignorance) and (b) conflicting accounts of the same phenomena, resulting in an irreducible form of uncertainty Funtowicz and Ravetz (1990) labelled 'epistemological.' Faced with this uncertainty, the PNS approach does not seek to reconcile conflicting perspectives into one 'true' representation of the issue, but relativises them; encouraging their co-existence. 'Quality' becomes the organising principle of knowledge rather than 'truth;' the focus of a 'post-normal' setting is not on discovering the 'truth,' but on mobilising the *best quality knowledge specific to a given issue*. The principle of quality is a common principle across otherwise incommensurable perspectives (Funtowicz & Ravetz, 1993). To this end, the

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[3] The concept of 'normal science' is proposed by Thomas Kuhn (1962) in his seminal work 'The Structure of Scientific Revolutions,' which describes the evolution of disciplinary science as 'puzzle-solving.'

post-normal science-policy interface employs the various stakeholders – from scientists, to state actors, to private sector actors, to civil society – as a form of *'extended peer community,'* who simultaneously contribute knowledge and evaluate it. This 'extended peer review' process allows those with a stake in governance to collectively agree on their own contextual measures of knowledge quality relative to an issue, and apply those measures to the various perspectives offered (Funtowicz & Ravetz, 1993).

Though not explicitly mentioned in any of the foundational documents of SPICOSA, the Project embodies many of the same characteristics as the PNS approach, and can be considered as a practical expression of the PNS epistemological position, as summarised in Table 1. Indeed, SPICOSA appears to at least implicitly endorse the PNS position through its engagement of partners heavily involved in PNS-type research to write 'Work Package 1,' as that section of the Project devoted to developing deliberative DST with a quality-focus (SPICOSA Project, 2010). Following PNS, SPICOSA starts from a perspective that fragmented disciplinary science alone is not adequate for understanding the complexity associated with ecological-social-economic systems, and proposes DSS/DST as means for structuring the dialogue within a participatory and integrated, yet robust and scientifically sound, science-policy interface. In particular, through the use of the stakeholder mapping Deliberation Support Tool, all coastal stakeholder's perspectives on an issue are able to be admitted as pieces of evidence. This evidence is proposed to be integrated through reciprocal dialogue in the construction of the SAF, and later in deliberation framed by the 'Matrix.' SPICOSA thus aims to employ a "communicative *mediation* role between scientific knowledge and other sources of knowledge in the policy arena" (SPICOSA Project, 2010, p. 52).

SPICOSA recognises the variability of coastal issues across different contexts, replete with their diverse perspectives and uncertainties. The Project is therefore designing *generic* means for mobilising, structuring and communicating the best available knowledge for *specific* issues (IFREMER, 2010). The tools of SPICOSA are anticipated to encourage an evaluation of the quality of knowledge via a form of 'extended peer review' amongst coastal stakeholders, at two stages: (i) through the interactive design, formulation and appraisal of the SAF; and (ii) through the use of the multi-media 'Deliberation Matrix,' where stakeholders can appropriate knowledge as 'indicators,' including from the SAF, and simultaneously provide an explicit judgement of the indicator's quality. Thus stakeholders' choice of indicators will provide, "…a key input to (their) assessment of scenarios and to the quality of their evaluation in a participatory or deliberative context" (SPICOSA Project, 2010, p. 52) The 'Description of Work' document anticipates, "…both the 'face to face' participatory exercises and the multi-media based deliberation, when inserted into the SAF methodology, will give prime importance to the quality of the

information it processes and balance in considering the ecological, social and economic dimensions"
(SPICOSA Project, 2010, p. 53).

Table 1: Characterising the SPICOSA Project as a 'post-normal science' approach	
Principles of post-normal science	SPICOSA performance
1) Focussed on the science-policy interface in support of decision-making for issues characterised by uncertainty, plurality and high stakes.	SPICOSA has an explicit focus on restructuring knowledge within the science-policy interface, through DSS/DST.
2) Complex social-ecological systems perspective.	SPICOSA, through the SAF in particular, proposes structuring knowledge according to complex systems modelling.
3) 'Epistemological' uncertainty is explicitly recognised as inevitable and irreducible, necessitating a precautionary approach.	SPICOSA explicitly recognises uncertainties within the study sites, but espouses a less strong perspective on uncertainty; asserting it is reducible.
4) Dialogic setting wherein knowledge is mobilised and negotiated as 'evidence' in support of normative arguments.	The DSS/DST of SPICOSA are to encourage reciprocal dialogue across diverse actors; particularly in developing the SAF and within deliberation structured according to the 'Matrix.' Moreover, the DST are designed so that results from the SAF can be appropriated as evidence within deliberations, particularly through the 'Matrix' where stakeholders appropriate SAF science in the form of weighted 'indicators.'
5) Participatory setting admitting a plurality of equally valid perspectives.	SPICOSA attempts to construct a participatory and deliberative science-policy interface setting. Through 'stakeholder mapping,' the diverse perspectives of all classes of stakeholders are to be admitted access for modelling and deliberation.
6) Relativise, and where possible reconcile, conflicting perspectives according to principles of reciprocity and co-existence	SPICOSA proposes to both reconcile and relativise conflicting perspectives. Through the SAF, conflicting perspectives are reconciled into a coherent model of the issue. Equally, the parallel deliberation structured according to the Matrix allows the coexistence of diverse perspectives.
7) Conflicting perspectives are evaluated for their *quality* in terms of supporting decision-making for an issue. Quality is the organising principle of science rather than 'truth.'	SPICOSA places central importance on mobilising the most high quality knowledge possible via DSS/DST. This is quality explicitly judged in terms of supporting the specific policy questions within the study sites. Quality is judged within the context of the SAF, and through the structures of the 'Matrix.'
8) Stakeholders as members of an 'extended peer community,' which collectively evaluate knowledge according to collectively-derived criteria of quality; 'extended peer review.'	Within SPICOSA, two parallel peer communities can be distinguished: (a) the Policy-Stakeholder Participant Group developing the SAF, who can arrive at common measures of knowledge quality for its inclusion in the model; and (b) the wider study site stakeholders/endusers, who deliberate with the aid of the DSS/DST, and pass evaluation on knowledge quality.

9) Reflexive	SPICOSA is inherently reflexive given its basis in integrated assessment; with an (a) iterative and (b) deliberative focus.
10) Social learning orientation in pursuit of understanding rather than truth	Interactive and iterative learning is central to SPICOSA, as represented in Objective (6), and its strategic vision.
11) Adaptive cyclic process, with outcomes judged on the quality of the process.	Integrated assessment is by definition an iterative process. Within the SAF, modelling of the system is an iterative process through four stages. Also, interaction between the policy and the science arenas is demonstrated as iterative (see Figure 1).
12) Strategic, long-term perspective	SPICOSA places importance on the longevity of its DSS/DST, and the residual learning/expertise among participants at the conclusion of the Project. This is part of a strategic vision toward sustainability and ICZM.

SPICOSA as an opportunity for reflexivity centered research using the KerDST as a proxy to a PNS framing of ICZM

By framing the SPICOSA Project as a 'post-normal science' approach to mobilising knowledge in support of ICZM, this distinguishes the Project as a novel way of structuring the science-policy interface. While the scholarship and practice of ICZM has shown a growing tendency to view the science-policy interface as a participatory and deliberative setting within a 'governing system,' the PNS perspective has found scant expression. A review of the published ICZM literature found few examples of initiatives that emulate the characteristics of PNS, and none that have explicitly endorsed the PNS perspective. While SPICOSA has not either explicitly labelled itself as an exercise in PNS, it does espouse a combination of characteristics that collectively comprise a post-normal approach, and in so doing distinguishes itself as a unique approach for the mobilisation of knowledge within the field of ICZM. As a novel epistemological approach, this research aimed to explore the way in which a post-normal science-policy interface, as practiced in the SPICOSA Project, has had an effect on coastal governance.

SPICOSA provides a unique opportunity for research into the effect of a post-normal science-policy interface setting on coastal governance outcomes. By simultaneously applying a standardised portfolio of tools across 18 diverse study sites, SPICOSA allows for a robust comparison of the tools success within different contexts, and by extension enables some comment on the value of a PNS epistemological approach for wider ICZM theory and practice. Indeed, SPICOSA is a rare initiative in that it focuses on reproducing one sole institutional setting – the science-policy interface – across many case studies to analyse its success within the wider *de facto* coastal governance context, including existing ICZM programmes. In contrast most ICZM initiatives seek to implement a more comprehensive approach combining multiple stakeholders, across multiple institutional settings, at multiple scales to

influence the coastal governing system at multiple points; with the result that causality between the different components of an ICZM initiative and positive outcomes can be confounded. Therefore, by

(a) focussing on the science-policy interface as one particular component of coastal governance, and (b) reproducing this interface across a wide range of contexts, SPICOSA adds some control, legitimacy, credibility and generalisation to the experimental implementation of its tools. This research seeks to explore the implementation across a subset of four of SPICOSA's study sites.

Having framed the SPICOSA Project professed epistemological approach, and its anticipated *ex ante* coastal governance outcomes, this report now turns to explore the Project in practice. **To reiterate the research question,** this research sought to undertake inductive research, via an *ex post* analysis and evaluation of the SPICOSA Project within four study sites, to determine:

What is the effect of the SPICOSA Project, and its 'post-normal' framing of the science-policy interface, on coastal governance according to the principles of ICZM?

This roughly equates to the evaluation of the two 'coastal governance outcome' objectives of the SPICOSA Project (Section 2.1), which respectively aimed to: (a) improve the science-policy interface institutional setting through the qualification of complex systems (Objective 2); and (b) improve the communication and integration among coastal stakeholders (Objective 5). The focus of the research presented here was therefore on the quality of the governance outcomes of the SPICOSA Project rather than the quality of its scientific outputs, or the quality of the learning that has occurred.

Analysing and evaluating the effect of the SPICOSA Project on coastal governance outcomes: conceptual framework and method

In order to gain the necessary reflexive distance from the KerDST tool itself, we chose to evaluate governance outcomes, framed by our post-normal science argument. This approach allows for a better understanding of where key prerequisite of the deployment of deliberative decision making may have been challenging in the course of SPICOSA.

Conceptual framework of analysis and evaluation

One key challenge of the SPICOSA Project may lie in its evaluation beyond its specific outputs. Though the Project includes coastal governance objectives, it did not from the outset establish an explicit framework for the evaluation of the social dynamics within the science-policy interface and the wider coastal governance outcomes at the study sites. It was not until the Project's third year that a suite of

programmes were introduced, devoted to the evaluation of social elements/impacts of the SPICOSA Project and its governance outcomes. To address the above research question, the research that is presented here therefore developed its own evaluation framework, which later became incorporated within one of the third-year evaluation programmes; the 'Lessons Learned' evaluation initiated in November 2009 (see Section 3.2). This framework is in two steps:

(i)   Analysis of the way in which the SPICOSA Project frames the science-policy interface

As a first step, this research began with an analysis of the way in which the SPICOSA Project, and its tools, had an effect on the way coastal stakeholders collectively mobilise knowledge in support of decision-making for a given issue in each study site. This was a critical examination that sought to determine the essential elements of the science-policy interface within the SPICOSA Study Sites. This analysis was undertaken through the lens of 'post-normal science' and was thus structured in terms of the principles of PNS listed in Table 1 of this report, and the degree to which the study sites emulated these elements. That is, in what way did SPICOSA shape the science-policy interface setting, and to what degree could it be called 'post-normal?'

(ii)   Evaluation of the effect of SPICOSA Project on coastal governance outcomes

As a second step, this research sought to evaluate the effect of the SPICOSA Project on coastal governance outcomes, or what could also be termed 'governance capacity.' As noted, the SPICOSA Project begins from a 'coastal governance' perspective;[4] specifically focusing on the science-policy interface institutional setting as a means for channelling the best available knowledge to support society's collective deliberation on the most appropriate 'social choice' for the coast. Given this governance focus, SPICOSA suggests that, "a pragmatic evaluation approach would be to frame the problem of 'social choice' as a multi-stakeholder deliberation about the merits and demerits of policy alternatives that present themselves to society" (SPICOSA Project, 2010, p. 51). In accordance with SPICOSA's governance focus, this research measured it's environmental governance outcomes through the lens of 'interactive governance,' (Kooiman, 2003) with respect to two complimentary components of governance: (a) the quality of institutional settings (including the science-policy interface); and (b) the quality of stakeholder interactions within and across these institutional settings.

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[4] Within the scholarship of ICZM, coastal governance is often discussed in terms of 'interactive' or 'social political' governance, which Kooiman and Bavinck (2005) describe as:

'… the whole of public as well as private interactions taken to solve societal problems and create societal opportunities. It includes the formulation and application of principles guiding those interactions and care for institutions that enable them.'

This framework has been used in other coastal research and is described in detail elsewhere, suffice to summarise it:

(a)   Institutional outcomes: this refers to the effect of the SPICOSA Project on creating 'high quality' institutional settings for coastal governance, as defined within the principles of Integrated Coastal Zone Management. The scholarship and practice of ICZM represents decades of reflexive research on effective institutions for coastal governance and has been endorsed by the European Union as one key motivation for the SPICOSA Project. Through the distillation of 'success factors' from past initiatives, ICZM is able to formulate 'principles' to guide future initiatives (see e.g. Stojanovic, Ballinger and Lalwani (2004), and Christie (2005)), with these principles able to be appropriated as measures of 'institutional quality.' For the evaluation of SPICOSA, given its status as an EU Integrated Project, this research used the eight principles of good ICZM agreed as part of the EU ICZM Recommendation in 2002 as measures of 'quality' coastal institutions (see Appendix A).[5]

(b)   Interaction outcomes: this refers to the effect of the SPICOSA Project on the quality of coastal stakeholders' interactions and dialogue in engaging in collective deliberation and decision-making for coastal governance. The best way to measure the quality of collective decision-making is widely debated across diverse fields of scholarship including within 'collaborative management' (see e.g. Innes (1999)), and research into 'adaptability' of society in ecosystem-management (Berkes, 2007; Folke, Colding, Olsson, & Hahn, 2007); both of which have been influential on ICZM and SPICOSA. Starting from these two schools of thought, this research proposes measuring the quality of interaction and dialogue in terms of the different forms of 'capital' upon which stakeholders can draw in deliberating (Resilience Alliance, 2007). Three forms of capital were measured: (i) financial capital as a measure of the funds allocated to facilitating effective deliberation (effective decision-making is not cheap); (ii) human capital as a measure of the competence among the individual stakeholders for reasoned deliberation; and
(iii) social capital as a measure of the social cohesiveness of stakeholders, including the informal institutions of trust and reciprocity that facilitate more effective dialogue for collective decision-making. For a list of indicators of these three forms of capital, see Appendix A.

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[5] This evaluation framework has been applied within other research for Integrated Coastal Management. Where it has been applied elsewhere, 'institutional outcomes' have been measured according to principles developed by Stojanovic, Ballinger and Lalwani (2004), which the authors determine to be derived from a more comprehensive study than the EU 'Demonstration Programme.' However, given SPICOSA is an EU Project, the EU principles were deemed more appropriate for this particular evaluation.

Research method within the SPICOSA Project

This research drew on the SPICOSA evaluation programmes as the method of data collection, however as noted this was complicated by SPICOSA's emphasis on the evaluation of outputs and the satisfaction of output-type objectives (see Section 2.1 above). This is both output evaluation at the operational or administrative level (setting deadlines by which outputs or 'deliverables' are to be produced and monitoring the implementation of these work plans; in large part to satisfy contractual requirements) and evaluation of the research 'products' of SPICOSA according to their own internal measures of quality. As such, many of the formalised evaluation efforts are attached to specific deliverables and comprise a number of internal criteria, including the internal coherence and consistency between outputs for example. This output-focus extends to the implementation of SPICOSA within the study sites, where the primary objective is the implementation and critique of the SAF Protocol, by following the SAF method as closely as possible, and reporting on the experience. Evaluation within the study sites is hence largely limited to the development of a method according to internal measures, rather than its effect on a wider context according to external, contextual measures. That noted, there have been evaluation efforts of outcomes 'beyond' the SPICOSA deliverables, including the social learning that has occurred in their preparation, and their influence on coastal governance outcomes. [6]

This research drew primarily on data collected through the 'Lessons Learned' evaluation programme that emerged in the third year of the SPICOSA Project to "assess the contributions of the SPICOSA 'Systems Approach Framework' to Integrated Coastal Zone Management," within the study sites. The Lessons Learned programme represented a convergence of a number of evaluation efforts; incorporating a composite of questions to satisfy parallel evaluation initiatives, including the research presented in this report. Resultantly, it shared a number of objectives with this research:

- To review how the implementation of the SAF has contributed towards building knowledge, and how that knowledge has improved ICZM practices;

- To review the local effect of the SAF on coastal institutions in terms of the 8 ICZM Principles (of the EU);

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[6] Though the primary objective within the study sites is to implement and critique the SAF outputs, coastal governance outcomes also find expression within the specific objectives of 'Work Task 7;' see Objectives (3), (2) and (5).

- To review how stakeholders have developed their capacity (see: stocks of capital) for contributing to ICZM;

This research also drew on data collected through a SPICOSA reporting procedure (Deliverable 14.9) placed on study sites to annually report on stakeholder participation, the subsequent form of the science-policy interface, and any future plans for collaboration across the science-policy interface.

The Lessons Learned survey selected a sub-set of five SPICOSA study sites to investigate on the basis of both (i) their variable advancement in terms of formal Integrated Coastal Zone Management programmes, and (ii) the diverse issues that they faced. Owing to data availability, this report's research has been limited to the analysis and evaluation of four of these sites, though this is deemed an adequate set for a rich exploration into a diversity of experiences. The Lessons Learnt survey was undertaken using a semi-structured interview framework comprising a standardised set of questions and prompts to aid the comparability of the results. Confidential interviews were carried out by SPICOSA partners at a SPICOSA Conference in February 2010, where face-to-face interviews were undertaken with a single SPICOSA-partner representative from each of the five study sites – invariably represented by scientists and researchers from research institutes.[7] Interviews were recorded, and a transcript sent to respondents for validation, after which responses from all study sites were condensed into a spread-sheet for coding and analysis.

There are four key restrictions attached to the above research method. Firstly, by undertaking interviews with only one representative from each site, this biases the responses in terms of one perspective. Secondly, the respondents were all SPICOSA representatives, and may therefore have been more inclined to report positively on the Project of which they are a part, and which may reflect on their ability to implement the tools. Thirdly, the interviewers were also SPICOSA partners, which may serve to bias the responses by a desire of the interviewee to please the interviewer; themselves part of the SPICOSA community. Finally, the research would have been more robust had it been able to integrate data from other parallel evaluation programmes looking at social learning and the social processes that characterise stakeholder interaction within the SPICOSA science-policy interface.

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[7] The authors would like to acknowledge Jeanette Reis and Tim Stojanovic of Cardiff University who undertook the interviews for the Lessons Learned survey.

The effect of the SPICOSA Project: Results and Discussion

Four different contexts

The SPICOSA Project Study Sites represent a diverse array of coastal contexts scattered across European nations, and indeed in many cases, focus on coastal features that span national boundaries. The four study sites chosen for this research are no exception; posing four completely different challenges to coastal governance. To borrow from coastal governance authors (see e.g. Jentoft and Chuenpagdee (2009)), the diversity across these four sites is seen not only in the different types of issues they face in their ecological-social-economic 'systems-to-be-governed,' but also their unique governance response within the 'governing system.' Indeed, the capacity of governing systems significantly determined the form SPICOSA took in each context. For instance, though SPICOSA is in the service of ICZM, the degree to which the study sites have formally, or informally, given effect to the EU's ICZM imperative ranged from advanced initiatives to virtually nothing whatsoever; with demonstrable consequences for the SPICOSA science-policy interface.

Cork Harbour

Cork Harbour is a large (100km²), sheltered, naturally deep harbour with strong estuarine influences, situated on the south coast of Ireland. While contemporary use of the Harbour is marked by concentrations of urban populations and industry, much of the coast is characterised by agricultural land or protected habitats. Its deep, sheltered channels make the Harbour ideal for shipping and recreational boating. As such this study site is focussed on the policy question of, 'how to optimise the potential for expanding the leisure boat sector in the context of Cork Harbour's multi-use environment?'

The Cork Harbour study site represents the most advanced ICZM programme of the four contexts; having been initiated in 2003, respondents now described it as 'well-developed.' Though governance of the Harbour remains divided between various national, regional and local government agencies, according to an array of policy instruments, ICZM has introduced mechanisms to encourage integration. The Cork Harbour Forum is a partnership involving stakeholders from civil society, the private sector and the state, as part of ongoing efforts to develop and implement the 'Cork Harbour Integrated Management Strategy;' and is supported in this task through the Strategic Advisory Group (SAG) and Focus Group subsets. In initiating the SPICOSA science-policy interface, local SPICOSA partners drew on the Forum as a pool of stakeholders; effectively attaching SPICOSA to the Forum and its goals. A small group of SAG members agreed to support the Project as stakeholder participants - comprising

representatives of local councils and the navy – however the wider members of the SAG and the Forum remain linked to SPICOSA in terms of commenting on its results. An initial meeting was called with the SAG participants, to reach consensus on the policy issue, though subsequent meetings have been informal, taking advantage of already frequent Forum/SAG meetings. These informal meetings do not therefore always include all original participants.

The Rhine-Meuse-Scheldt Delta

The Rhine-Meuse-Scheldt Delta is a 100km-long delta and adjacent coastline spanning the border between the Netherlands, Belgium and France; formed by three major European rivers. This coastline presents a varied environment from sandy beaches to the Scheldt Estuary. It is a heavily populated coastline, including Rotterdam and Antwerp, with recreation, agriculture and aquaculture as dominant economic activities; necessitating at times heavy coastal protection works. This study site is focussed on the issue of ensuring the good ecological quality of phytoplankton in the Scheldt River basin, including the coastal zone (as required under the EU's Water Framework Directive); or more specifically, the feasibility and costs of nitrate reduction.

The Scheldt Delta study site is not governed according to an integrated ICZM initiative specific to the delta. Rather, given the delta bridges three nations, the status of ICZM differs across the various nations; with the Netherlands for instance instituting ICZM in 2005, and advancing to a developing-well developed stage. Given the selected water quality issue, governance is largely according to those agencies responsible for implementing the EU's Water Directive Framework (WDF); including the International Scheldt Commission (ISC) responsible for the transboundary WDF, and central government agencies in France, Flanders (Belgium), and the Netherlands. In initiating the SPICOSA science-policy interface, local SPICOSA partners organised a first meeting to decide on the policy issue; inviting diverse stakeholders from within Flanders and the Netherlands. By selecting an issue implemented principally at the national scale, many stakeholders lost interest, leaving only the ISC and national water agencies. Subsequent to the first meeting, contact was through separate meetings in France, Flanders and the Netherlands, and intensive contact with individual representatives between meetings; with the purpose of providing significant knowledge to the fuel the SPICOSA Project assessment.

The Guadiana Estuary

The Guadiana Estuary is a long, narrow river estuary located in south-east Portugal, and forming the border with Spain. The most important activities within the estuary are aquaculture, fisheries and tourism/recreation, with agricultural activities dominating the surrounding land. This study site is

focussed on the issue of decreasing water and sediment quality, owing to: (a) increasing discharges of untreated wastewater; and (b) decreasing freshwater discharges from dams.

The Guadiana study site has had a formal ICZM initiative in the form of the Guadiana Forum since 2006, though respondents reported it to be in its infancy. Governance from the Portuguese side remains divided between the central ministries, the regional departments and the local councils, while on the Spanish side governance is divided between the autonomous regional government of Andalusia, and it's local provinces and municipalities. To initiate the SPICOSA science-policy interface local partners met with a diversity of stakeholders - from across civil society (NGO's), the private sector, and the state - to invite their participation; firstly in the completion of a questionnaire, and later through more active participation. The response in Portugal was very positive, with participation of stakeholders largely in the form of one-way knowledge-sharing to allow SPICOSA's modelling of the issue; with the promised 'reward' of a detailed description of the issue. Through this collaboration, ties have been strengthened as expressed through other projects; from 'educational walks' held by NGO's, to radio and television interviews, to organised workshops and talks. In terms of the existing science-policy interface, the local SPICOSA partner organisation had already produced a multi-media tool to frame qualitative information on the estuary which had been very successful in terms of acceptance (schools, governance stakeholders); with SPICOSA forming a quantitative addition to this tool.

The Barcelona waterfront

The Barcelona waterfront represents a 30km-long stretch of beaches and urban construction marking the coastline of the city of Barcelona (population: 4 million) in Catalunya, Spain. Along the coast there are tourism activities, recreational and commercial harbours, some fisheries, waste effluents and two waste water treatment plants. This study site is focussed on the policy issue posed by the effects of changes in water quality on the aesthetic and recreational aspects of the Barcelona beaches.

Respondents reported that the Barcelona study site has no formally-recognised ICZM initiative in place. The governance of the coastal environment is shared to a degree between Spain's national government, the autonomous regional government of Catalonia, and the city and province of Barcelona, according to their various statutes of autonomy. In practice however, the majority of governance is vested in Barcelona city council, with jurisdiction over the coastal marine area being transferred from national to local government. To initiate the SPICOSA science-policy interface local partners invited five local representatives, largely from state organisations, to attend a first meeting with SPICOSA scientists. The agenda of this meeting was set by the scientists. At this meeting, stakeholders suggested other state representatives that might be usefully included for the issue however they were not eager to participate. Subsequent interaction was via regular meetings with the original representatives. Though

interaction between the particular scientists and policy-makers involved in SPICOSA was not itself new, the integrated, whole-system approach was novel for the science-policy interface.

Analysis of the SPICOSA science-policy interface through the lens of post-normal science

As noted, the implementation of SPICOSA in each of the study sites was analysed through the lens of post-normal science according to the principles contained in Table 1. The following analysis is therefore structured in part according to the principles of PNS.

A science-policy interface integrated within the coastal governance context[8]

The SPICOSA Project set out to shape the science-policy interface in the service of ICZM, with the expectation that SPICOSA would respond to the political situation and practical needs of ICZM within each study site. For the three study sites with some form of ICZM programme in place there was general consensus that the SPICOSA science-policy interface was well nested within the existing programme, and linked closely with an issue of central importance to local coastal governance. Similarly, when asked to what degree they felt SPICOSA was well engaged with the formal policy/planning process within a context, all study sites responded positively; noting that it was either well engaged now, or was anticipated to be well engaged in the near future as SPICOSA built up momentum and visibility. On the contrary, when asked to what degree they felt SPICOSA was integrated with the wider (at times informal) deliberation among coastal stakeholders the response was divided. Two study sites felt it was well integrated as it was linked directly to a policy issue of interest, and was creating indicators of use to deliberation. However two others felt that it was not well integrated, and that the knowledge generated was not fulfilling decision-making needs. Finally, when asked whether SPICOSA was adapting along with the issue and its governance response, there was consensus that SPICOSA was too short-term to allow for demonstrable change over time.

A complex systems perspective for greater learning and understanding/recognition of uncertainty[9]

Central to SPICOSA is its complex 'ecological-social-economic' systems focus, and the desire to express coastal issues holistically within the science-policy interface. To this end, there was general agreement across respondents that SPICOSA did lead to a more comprehensive understanding of the policy issues, with this understanding extending to interactions between marine and terrestrial systems,

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[8] PNS Principles 1, 11 and 12 from Table 1

[9] PNS Principles 2, 3 and 10 from Table 1

the thresholds or carrying capacity of these ecological systems, and the effects of human activities on ecosystem health. For two study sites, this more comprehensive vision of the issue, "raising the profile of importance of all components of a system," was one of the most novel and valuable contributions of SPICOSA to ICZM. Conversely, though no less valuably for two study sites, SPICOSA also provided a useful setting for the identification of uncertainties and knowledge gaps; "it has highlighted a key underlying issue concerning the lack of data." SPICOSA revealed for many participants how often important decisions are made without perfect knowledge, or even a good understanding. Finally, associated with this comprehensive understanding is the 'social learning' that has occurred among all participating stakeholders; though this is largely limited to the systemic components of the issue. To encourage learning beyond the participants, all study sites have initiated, or are scheduled to initiate, arrangements for the sharing of their SPICOSA knowledge; through newsletters or educational programmes for instance.

Reflection on a dialogic science-policy interface [10]

The study sites revealed a reflexive approach to the science-policy interface that saw them place science in a supporting role to stakeholders and their deliberation, rather than at the centre of a science-centric setting. One site revealed that they had considered re-phrasing the interface as a 'policy-science interface' in recognition of "science at the service of policy." This view endorses a governance perspective – "with scientists just one group among a diversity of stakeholders" - and encourages listening to other stakeholders first, before "seeking to assess where best that science can offer a means to an end, instead of offering an end in itself." To this end, all four case studies expressed the importance of the 'soft' tools offered by SPICOSA for framing dialogue between stakeholders and scientists: "with good stakeholder analysis, conceptual mapping and Deliberation Support Tools, you don't need modelling." All respondents reported on the utility of stakeholder mapping, as a means for the identification and collaboration of stakeholders, and for "encapsulating perceptions of environmental reality." Respondents saw 'conceptual mapping' as a natural progression from stakeholder mapping, to allow a broad scale identification of the "different views on how the system works and…the uncertainties;" while allowing for the 'fuzziness' that accompanies uncertainty, plurality and politics. Finally, three of the case studies emphasised the importance of DST like the Matrix for structuring deliberation such that knowledge is appropriated as evidence for arguments. Conversely, respondents perceived the 'hard,' quantified computer modelling as difficult to complete given the demands of time

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[10] PNS Principles 4 and 9 from Table 1

and data, and had limited legitimacy among stakeholders. As one site noted, 'the focus on 'black box' modelling and complex documents has not been welcomed.'

A participatory setting admitting a plurality of perspectives[11]

Associated with a concern that the science-policy interface should not be a science-dominated setting, a number of respondents expressed the importance of participation; accepting a diversity of stakeholder perspectives. However, that noted, not all study sites were able to give effect to a participatory setting; in large part owing to the governing system context within which they were set. Only one study site felt that it was able to include the participation of a full diversity of stakeholders, and this is largely due to the existence of previously established ICZM participation mechanisms. One of the other study sites, which spanned a national boundary, reported asymmetrical participation, and while they were able to encourage participation from the full spectrum of stakeholders, this was restricted to within one nation only, and was therefore not fully representative. The two other sites commented that their participation was too heavily weighted in terms of state agencies. As such, only one site was able to effectively incorporate local knowledge, with the other sites largely restricted to 'high level' input from state representatives.

Relativising conflicting perspectives through reciprocal dialogue[12]

Related to the question of participation, is the question of how case studies addressed plural and sometimes conflicting perspectives. For two case studies, conflicting perspectives did not exist, or where they did there was enough of an understanding of the issue that the 'correct' perspective could be determined. Two other case studies acknowledged the presence of conflicting perspectives; both in terms of the perceived elements of the issue, and the different standards on the collection and use of knowledge. In addressing these conflicting perspectives, the case studies attempted to be as transparent as possible, to allow for an open interpretation and communication via reciprocal dialogue.

Addressing knowledge quality through dialogic evaluation[13]

Though no specific questions explored the study sites' evaluation of knowledge quality, an implicit 'dialogic evaluation' became evident. Some respondents noted the strength of SPICOSA lies in its ability to deliberate multiple stakeholder perspectives on the 'reality' of an issue, and their associated uncertainties; encapsulating ideas of reflection, learning and critique. One respondent saw SPICOSA

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[11] PNS Principle 5 from Table 1

[12] PNS Principle 6 from Table 1

[13] PNS Principles 7 and 8 from Table 1

as creating an "interdisciplinary platform for interdisciplinary data," bringing with it cross-disciplinary evaluation. Another respondent noted that they chose data supported by the politics of the issue rather than data supported by a robust scientific method; demonstrating knowledge 'quality' according to what the stakeholders perceive to be important for the issue. None of the study sites verified a dedicated and explicit means for evaluating knowledge quality, through 'extended peer review' for instance.

Critique of SPICOSA

Respondents were asked what they would do differently if they had the opportunity to implement SPICOSA again. In this, only one respondent limited their comments to the mechanics of the SAF, with the most common consideration being how the social element could be improved. This ranged from the means of 'recruiting' stakeholders to participate, to suggestions of omitting hard modelling completely from the first iteration, and restricting the process to stakeholder mapping, conceptualisation, and deliberation via the 'Matrix.' One respondent offered a detailed list of ways in which to improve the social dimension; "The social dimension in my opinion has much more to do with the process of decision making, social networks and governance structures than with a mathematical formulation." This respondent framed SPICOSA's integrated assessment process in the service of a 'social-choice' problem; necessitating social settings within which dialogue is encouraged as a means for eliciting that knowledge relevant to the decision-making process. They felt SPICOSA had placed too great importance on a numerical model as a means to support qualitative deliberation, "the complexity of the models has thus been excessive and irrelevant to the deliberation within the Matrix (amongst stakeholders)."

Governance outcomes: Institutional quality

Study site respondents were asked to what degree the SPICOSA Project had affected coastal governance institutional settings, including the science-policy interface, that are more in keeping with the principles of good ICZM, as endorsed by the EU's ICZM Recommendation (see Appendix A). Their responses are summarised below according to the 8 different principles.

1. A broad overall perspective of interdependent natural systems and human activities

In general, respondents felt that the SPICOSA science-policy interface had led to a more comprehensive understanding of the policy issue, except with regard to cumulative effects. Where SPICOSA was well integrated with decision-making in other institutional settings (within two sites), a comprehensive perspective and understanding extended to these settings.

2. A long-term perspective taking into account the precautionary principle

Most study sites did apply a long-term perspective relative to environmental cycles, often in the vicinity of 40-50 years, however one respondent noted that could not look long-term economically owing to the influence of the discount rate. In addition, all study sites faced difficulty in engaging stakeholders in governance and building relationships with a long term perspective, including for mobilising knowledge, owing in large part to the short-termism of political cycles.

3. Adaptive management

The general consensus across respondents was that SPICOSA's science-policy interface was well integrated with the existing ICZM framework and the cyclic policy-making process within their study sites, or was anticipated to be in the near future. On the contrary, respondents were divided on how effectively integrated SPICOSA was with decision-making in other settings. Two study sites felt that it was not well integrated, and that the knowledge generated did not fulfil the needs of decision-makers. Two other study sites felt that SPICOSA, by devoting itself to a specific issue, was very relevant to decision-making on that issue in all settings. When asked whether the science-policy interface was adapting with the issue, respondents felt that the Project represented too short a timeframe to discern change.

4. Local specificity

For most study sites, SPICOSA led to a greater understanding of the contingent nature of their policy issue, both within and beyond the science-policy interface settings. For all respondents, this understanding led to a greater appreciation for the multiple policy options, instruments or interventions available for their given issue, and for two respondents this led to the formulation of two detailed policy options specific to their site.

5. Working with natural processes and respecting the carrying capacity of ecosystems

By employing a comprehensive systems approach to the policy issues, the SPICOSA science-policy interface proved able, in most sites, to enable: (a) the approximation of the carrying capacities or thresholds associated with ecological systems, and (b) the drawing of links between human activities and ecosystem health. For two study sites, this understanding pre-dated SPICOSA, but was nonetheless reinforced through the Project.

6. Involving all the parties concerned in the management process

Though SPICOSA respondents were encouraging of a participatory setting, in practice only one of the study sites was able to secure the participation of a representative and diverse collection of

stakeholders; owing largely to strong existing ICZM participation mechanisms. Within the other sites, participation was either restricted to state agencies, or was asymmetrical in terms of representation.

7. Support and co-operation between relevant administrative bodies

For the majority of the study sites the existing 'governing system' represented an established network of organisations, such that SPICOSA simply served to strengthen the 'de facto' integration, though for one study site SPICOSA contributed to building new interactions and integration. Moreover, all respondents identified future opportunities for collaboration between administrative agencies, and between scientists and these agencies. Notably however, respondents recognised that SPICOSA did not encourage cross-scale (vertical) integration, or influence future commitment from coastal stakeholders beyond state agencies.

8. Use of a combination of instruments for management

The SPICOSA science-policy interface did allow for a contingent and comprehensive examination of policy issues specific to the context, with this deliberation including a discussion of a suite of possible options for policy interventions; including legal, economic, technical, research, educational and voluntary options. This discussion successfully influenced deliberation and decision-making in some sites, however only two study sites advanced to the formulation of detailed policy options, and as of writing, these had not been implemented.

Governance outcomes: Interactional quality

Study site representatives were asked to what degree the SPICOSA Project had an effect on the quality of coastal stakeholder interactions and dialogue in engaging in collective deliberation and decision-making for coastal governance. The quality of interactions was evaluated relative to three different forms of capital that a governing system could draw on to improve deliberation, including: financial capital, social capital and human capital.

Financial capital

One key indicator of growing coastal governance capacity is the increased financial capital that it attracts to support participation and effective dialogue between stakeholders in a governing system; with financial capital defined as 'financial assets, such as currency, bank accounts, bonds, and stock, that can be used to store wealth and to purchase goods and services or other forms of capital.' Respondents were asked whether resources, in the form of financial capital or otherwise, had emerged as a result of the SPICOSA Project (separate to the SPICOSA funding). None of the study sites

revealed an increase in financial capital to support the science-policy interface or collective decision-making, with resources limited to the provision of data.

Social capital

Putnam (1993) defined social capital as "connections among individuals—social networks, and the norms of reciprocity and trustworthiness that arise from them." Plummer and FitzGibbon (2007) note a general intuitive sense that social capital strengthens communities by increasing socio-economic well-being and reducing the selfish utility-maximising behaviour expected of us by neo-classical economists and game theorists. To this end, there is a growing literature demonstrating social capital as an important pre-requisite of co-management and governance capacity (Pretty, 2003).

Respondents were asked questions on the interactions that formed or strengthened between stakeholders as a result of the SPICOSA Project, with variable responses. For one study site, a well-developed ICZM mechanism had already nurtured an extensive network of interactions across all categories of coastal stakeholders ('horizontal' integration across state, civil society and private sector stakeholders), and across scales ('vertical' integration). SPICOSA therefore did not create any new interactions, though did serve to strengthen some of the existing interactions. For two other study sites governance was limited within the state sphere, where a network of interactions was established between state agencies at the same scale, though there was little interaction with other stakeholder groups in civil society or the private sector or across scales. In these cases, SPICOSA's participation was largely limited to state agencies, and therefore did not encourage further interaction. The forth study site began with a weakly developed network of interactions between stakeholders, and reported a definite increase in the interactions at the local/regional scale; both within stakeholder categories and across stakeholder categories. Vertical interaction was not increased however, and indeed deteriorated as a result of a contentious issue. Related to interactions, respondents were asked whether SPICOSA had encouraged new stakeholders to subsequently participate in coastal governance, though only one study site revealed stakeholders who began participating as a result of the SPICOSA initiative.

Respondents were asked questions on how the interactions between stakeholders had developed, with regards to trust, cooperation and collective understanding. There were mixed results on the degree to which SPICOSA had nurtured trust; largely dependant upon the capacity of the wider governing system. One case study noted there to be no trust, but anticipated this to change, with local stakeholders deemed likely to develop more trust as knowledge is made available. Another study site perceived a slight increase in trust; noting that before there was none. A third study site described trust as having been already built as a result of an existing ICZM initiative. There was, however, more consensus on the increased presence of cooperation and opportunities for future collaboration. In general, the four

case studies perceived an increase in cooperation as a result of SPICOSA, as seen in the two-way sharing of knowledge and in terms of cooperative projects. Likewise, all study sites revealed future opportunities for collaboration that emerged from out of the SPICOSA Project. Finally, a collective or mutual understanding across all stakeholders, and the associated social capital, was variable across the study sites. For one case study, this collective understanding had already been built through previous ICZM initiatives, while two other study sites felt that an understanding had been built through the SPICOSA Project. One of these sites, however, preferred to define this in terms of an understanding as contained within individuals (discussed in terms of human capital) rather than a 'mutual understanding.'

Human capital

A third key indicator of increased governance capacity is the increased capabilities and competencies of the individual stakeholders to work with other forms of capital in a productive manner, for effective collective decision-making. This can be labelled 'human capital,' and defined as 'the stock of education, skills, culture and knowledge stored in human beings themselves' (Costanza & Daly, 1992). The Resilience Alliance (2007) for example, have stressed that a diverse and adequately educated and skilled network of stakeholders is essential to governance capacity.

Respondents were asked whether the SPICOSA Project was characterised by a diverse range of stakeholders, possessing a diverse range of knowledge, skills and experiences. On balance, the study sites did feel that SPICOSA had enabled the inclusion of a wider diversity of perspectives, however in other lines of questioning, only one study site revealed that they had been able to include a fully diverse and representative selection of stakeholder perspectives and local knowledge. One other site was able to include the participation of a diverse range of stakeholders, but was not able to access local knowledge.

Respondents were asked to what degree SPICOSA had led to discernable increases in 'wherewithal,' skills and leadership. In terms of stakeholder's 'wherewithal' or means to participate, both in time/resources and in terms of their eagerness, the majority of stakeholders across the study sites were paid state officials, and as such time and resources were not constraints as long as meetings were during normal working hours. Moreover, all respondents reported an increasing keenness among stakeholders to participate in what they deemed to be a novel project. In terms of stakeholder's skills and expertise for coastal governance, all sites reported an increase in skills and expertise, though the increase was variable across participants. The majority of participants in all cases were professionals, therefore possessing of a high degree of expertise/skills before SPICOSA. Increased expertise was therefore largely limited to modelling, and some elements of the systems science supplied for the

modelling. In terms of leadership, two study sites noted that state agencies had assumed a leadership role in championing SPICOSA.

Finally, respondents were asked to what degree they, and other stakeholders, had learnt more about the issue across three features: the nature of the issue, the values of other stakeholders, and the decision-making process. There was general consensus across the study sites that individual participants had gained a more comprehensive understanding of the policy issue in terms of the interacting ecological-social-economic systems, the thresholds of ecosystems, and the effects of human activities on ecosystem health. Though questions were more or less limited in their treatment of learning about stakeholder values and the decision-making process, no respondents proffered comment on learning of these elements.

Conclusions of this evaluation

What form did the SPICOSA science-policy interface take?

This report's second section started by describing the SPICOSA Project in terms of a 'post-normal science' approach to framing the science-policy interface, as evidenced by its similarity to the principles listed in Table 1; but what form did the interface take in practice? By focussing on one strategically-prioritised, complex and contentious policy issue within each study site, SPICOSA did create a science-policy interface setting that was well nested in the specific governing system context for that issue and well integrated with the formal policy/planning processes of the study sites (Principles 1, 11 and 12). Moreover, by viewing issues as linked ecological-social-economic systems, SPICOSA did provide for a more comprehensive perspective of both what is known about the issue, and equally what is not known (Principle 2). SPICOSA brought with it a realisation for many participants of how often decisions must be made in the face of significant uncertainties (Principle 3). The SPICOSA perspective also led to significant learning opportunities among participants, who professed to a more holistic understanding of the issue to support deliberation and decision-making (Principle 10).

In addition to allowing for a more comprehensive understanding of issues, SPICOSA led to reflection among its participants on the most appropriate science-policy interface for complex coastal issues (Principle 9). This led one study site to conceive of a 'policy-science' interface in recognition of the political dialogue across diverse groups that constitutes a governance setting, and science's supporting role as one small group supplying evidence in support of this dialogue. For all study sites, this emphasised the importance of 'soft' tools for framing a participatory interface (Principle 5) where knowledge is mobilised through dialogue between stakeholders and scientists with the goal of reaching a greater understanding of an issue, rather than simply accumulating 'facts' (Principle 4). Associated

with this, respondents also revealed the value of soft tools for integration; allowing diverse perspectives to co-exist along-side each other within reciprocal dialogue, or a conceptual model (Principle 6). This introduces the last feature which respondents reflected on, as an appreciation for what could be labelled the 'knowledge quality assessment' inherent in dialogue, and the co-construction of the soft tools (Principle 7). The SPICOSA experience showed that where stakeholders could see their various perspectives represented, they were more likely to accept the knowledge as having some qualities for decision-making; such as credibility, salience and legitimacy. On the other hand, SPICOSA's 'hard' computer simulation models (the SAF), while assembled according to a credible methodology, were at times deemed less legitimate and salient to the issue by stakeholders. Therefore for many participants, SPICOSA brought a realisation of the promise of a post-normal science-policy interface, and criticism of an interface predisposed to modelling alone.

However, in practice: (i) the specific governing system contexts, and (ii) SPICOSA's emphasis on modelling outputs, meant study sites were not able to give effect to the ideals of PNS. As noted, few study sites were able to facilitate the participation of a diverse and representative cross-section of stakeholders, with the result that most knowledge was derived from state agencies, and very little local knowledge was incorporated (Principle 5). Equally, as shown in Section 4.1, few sites were able to nurture a truly dialogic science-policy interface setting. In many cases the interaction was one-way, and best described in terms of stakeholders feeding knowledge into the SAF model. Often SPICOSA partners met separately with stakeholders or meetings were fragmented; limiting the opportunity for dialogue between stakeholders, (Principle 4). This limited participation and *ad hoc* dialogue had direct implications for both the degree to which diverse perspectives were integrated through the SPICOSA modelling tools or reciprocal dialogue (Principle 6), and the treatment of knowledge quality (Principle 7).

What effect did SPICOSA have on the quality of coastal governance institutions?

For each study sites' policy issue, SPICOSA was able to influence the form of the science-policy interface institutional setting, and where this setting was well integrated with other institutions, it influenced these also. In this way, SPICOSA was shown to improve the quality of coastal governance institutions as measured against four of the EU's Principles of good ICZM. In particular, SPICOSA constructed institutions that better gave effect to a board (EU Principle 1) and long-term (EU Principle 2) perspective of a specific and contextual issue (EU Principle 4), such that the issue can be understood in terms of the ecosystem's carrying capacity and health (EU Principle 5). On the other hand, the SPICOSA study sites had variable success in building institutional quality across the other four EU measures, again in large part stemming from governing system capacity and a focus on modelling. Specifically, study sites had difficulty in constructing participatory science-policy settings that were

inclusive of all diverse stakeholder perspectives (EU Principle 6), with repercussions for other EU Principles of institutional quality. Limited participation reduced the ability for SPICOSA to build collaborative interactions across coastal administrative bodies at various scales (EU Principle 7). In addition, with a number of study sites limiting their participation to state agency representatives and the formal policy sphere, their influence on decision-making within wider institutional settings (coastal industries, local fishing clubs, residents associations and so on) was limited; thereby reducing the number of coastal management instruments considered to those within the experience of the state agency participants (EU Principle 8). This more narrow focus has implications for society's wider adaptive management/capacity (EU Principle 3).

What effect did SPICOSA have on the quality of coastal stakeholder interactions for collective deliberation and decision-making?

This research was not able to see that the SPICOSA Project had a significant effect on the quality of coastal stakeholder interactions within the study site governing systems, as measured across the indicators used within this framework. Specifically, it did not appear to lead to an independent increase in financial capital, nor did it appear to have a significant impact on social and human capital. In terms of social capital, SPICOSA did lead to the construction of new interactions at one site, and strengthen existing interactions at another, but in general SPICOSA did not have a large impact on the connectivity of stakeholders. Likewise, while SPICOSA did conclusively encourage cooperation between participants, it had mixed success in nurturing bonds of trust and mutual understanding. In terms of human capital, SPICOSA had little impact on the diversity of stakeholders implicated in coastal governance, or their wherewithal and skills to participate. It did however lead participants to an increased understanding of the nature of the issue, and increased technical skills in modelling for example.

In conclusion

In conclusion, SPICOSA can be described in terms of a gap between the post-normal science-policy interface setting anticipated by the Project and its participants, and that setting that emerged in practice. While the Project found significant success in nurturing a comprehensive understanding of the issues, and participants reported the post-normal science approach as holding significant promise, there were barriers to giving effect to this perspective. As such, study site respondents reported variable success in affecting coastal governance outcomes; influencing collective deliberation and decision-making between coastal stakeholders across multiple institutional settings. This report suggests four possible reasons behind the gap between desire and practice:

i.   Within the context of a study site's long-evolving and contingent 'de facto' governing system, the SPICOSA Project represents a short-term experiment, imposed from without. SPICOSA must cede influence to other more well-established formal and informal local institutions; ranging from traditions, to other existing forms of scientific research.

ii.   In at least two study sites, participation was limited to state agency representatives, with the predictable consequence that its results were influential in supporting decision-making in the formal state policy/planning process, though less influential within other institutional settings, such as the local market, or civil society settings.

iii.   The specific tools offered by SPICOSA ranged from 'soft' tools which found wide acceptance from stakeholders, to 'harder' modelling tools which may have been perceived as more 'science-centric' and less salient or legitimate for the policy issue by some coastal stakeholders. Some respondents felt that SPICOSA had been too focussed on modelling outputs through its membership, its evaluation and its resourcing;

iv.   Experience within the ICZM literature demonstrates the significant inertia between changes in coastal institutions and effects on stakeholder interactions for collective decision-making; indicating that more long-term monitoring may have shown demonstrable change (see for example Olsen's (2003) 'Four Orders of Outcomes').

CONCLUSION

In this brief section we reflect on the various hypotheses closing the preceding section in the light of the way the use of KerDST has been envisioned within SPICOSA. The first element will focus on issue identification, KerDST first axis, the second element will focus on scenarios, KerDST second axis, and the third element will focus on KerDST third axis, the actors.

Issue identification

Within SPICOSA's the issue identification step was envisioned as part of a broader methodological approach, issue mapping. What was proposed is that issues be identified, their relationship being spelled out by stakeholders. This process of "issue construction" was fundamentally conceived as a stakeholder building dynamics. Nevertheless, this did not foresee the fact that this issue mapping process would move at a much slower pace than the modelling dynamics and this did not foresee as well that local resources within SSA were much more equipped in conducting the initial steps of the modelling process. This led to the very rapid "key issue" identification, sometimes not necessarily aligned to what stakeholders in their diversity may have expressed.

While within a SAF context, and with tight timeframe, this was totally justifiable, yet in terms of extended stakeholder involvement it may have been an opportunity-reducing approach. This points to a key tension point between a post normal approach to science and the modelling exercise. While within a post-normal context stakeholder involvement serves several goals simultaneously, within a modelling exercise stakeholder involvement may be limited to issue identification at the worst and for model co-construction at the best. This does necessarily allow for knowledge co-construction as a whole, which is a foundational hypothesis for the setting up of sustainable deliberative decision-making fora, such as those envisioned in a KerDST process.

While the role of the Deliberation is to permit a transparent presentation of the process and outcomes of judgements offered by each category of stakeholders, for each of the scenarios, across a spectrum of governance or performance issues, the identification early on of a "key" issue to be addressed, while enabling the realisation of the initial modeling steps, somehow made the use of the DM quite moot.

Scenarizing change for deliberation

A second element that may have somehow reduced the benefits of using the DM for science and policy integration may lie in the framing of scenario as defining elements for model based sensitivity analysis. As for issue identification and mapping, scenario building within the DM is seen as part of the social construction of a deliberation space. Once scenario are viewed either as preconceived regulatory of technological options, the social space that needs to be built, does not impose itself. One exception at

least within SPICOSA stands out. In the Pertuis Charentais SSA scenario building has been approached as a complex multicriteria definition of potential futures. This was very much stakeholder based which entailed quite some delays. This shows again how much social processes, and thus policy process, move at a rhythm that is not the rhythm of modelling.

Actors and deliberation

The third axis of the DW entails necessarily stakeholder presence and participation. This presence and participation must be built in the course of the building of the two other axes. This was not the case as explain above.

These three elements confirm somehow the conclusions of the second part of this report. The key lesson for future use of KerDST in coastal context indicates that it must be used from the onset, as a facilitation tool that will lead to post normal science practices down the road. The basic element is that before envisioning science policy integration in its fullest sense, the local "scene" for such an integration need to be constructed, that this takes time, and the somehow the scientific tools, such as models, must rather serve stakeholders, organized around KerDST rather than the contrary.

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Appendix A: Evaluation Framework

Eight Principles of Good ICZM as endorsed by the EU's ICZM Recommendation

Principle 1:

A broad overall perspective (thematic and geographic) which will take into account the interdependence and disparity of natural systems and human activities with an impact on coastal areas.

Principle 2:

A long-term perspective which will take into account the precautionary principle and the

needs of present and future generations.

Principle 3:

Adaptive management during a gradual process which will facilitate adjustment as problems and knowledge develop. This implies the need for a sound scientific basis concerning the evolution of the coastal zone.

Principle 4:

Local specificity and the great diversity of European coastal zones, which will make it possible to respond to their practical needs with specific solutions and flexible measures.

Principle 5:

Working with natural processes and respecting the carrying capacity of ecosystems, which will make human activities more environmentally friendly, socially responsible and economically sound in the long run.

Principle 6:

Involving all the parties concerned (economic and social partners, the organizations representing coastal zone residents, non-governmental organisations and the business sector) in the management process, for example by means of agreements and based on shared responsibility.

Principle 7:

Support and involvement of relevant administrative bodies at national, regional and local level between which appropriate links should be established or maintained with the aim of improved coordination of the various existing policies. Partnership with and between regional and local authorities should apply when appropriate.

Principle 8:

Use of a combination of instruments designed to facilitate coherence between sectoral policy objectives and coherence between planning and management.

Indicators of quality stakeholder interaction for deliberation and decision-making for ICM		
Financial Capital	**Social Capital**	**Human Capital**
1) Has there been increased funding of coastal management following an ICM programme? 2) Has the ICM programme created a sustainable source of financial capital?	1) Has there been an increase in the connectivity and density of stakeholder interactions associated with an ICM programme? 2) Have new stakeholders begun participating in coastal management as a result of an ICM programme? 2) Do interactions constitute 'bonding,' 'bridging' and 'linking?' 3) Do stakeholders perceive increased levels of trust and reciprocity within their interactions associated with an ICM programme? 4) Do stakeholders perceive a change in 'acceptable behaviour' associated with problematic resource use patterns? 5) Have there been examples of 'collective action' as a result of an ICM programme?	1) Do stakeholders have the wherewithal to participate in an ICM programme? 2) Have adequate expertise been accumulated associated with the ICM programme? 3) Is there an increased diversity of stakeholders participating in an ICM programme? 4) Have leaders emerged as a result of an ICM programme? 5) Do stakeholders recognise that, over the course of an ICM programme, they have learnt more about: a) the issue of concern; b) the values of other stakeholders; c) the network of stakeholders and rules of their interactions?