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Re-visiting ICM theory and practice: Lessons learned from the Baltic Sea Region

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Abstract

Sustainable management of coastal systems requires an iterative process using a multidisciplinary approach that integrates the three pillars of sustainable development: environmental protection, social progress and economic growth. The Systems Approach Framework (SAF) provides a structure for an Integrated Coastal Management (ICM) process with an effective science-policy interface that embraces the challenge of simulating complex systems and encapsulates citizen involvement from the onset. We analysed the findings of 16 re-analyses studies undertaken in eight Baltic Sea countries to test how well SAF elements had been applied in practice within ICM processes. The results revealed the main ICM driver was ecology or economy. Several ICM elements as defined by the SAF are already standard within the Baltic Sea region. However, in many cases, the omission of stakeholder and institutional mapping as instructed by the SAF led to an unbalanced participation of stakeholders, or in some cases, lack of involvement of stakeholders at the start of the process. Most of the ICM processes failed to include an integrated, cross-sectorial, ecological-socio-economic assessment. This extends from the lack of system thinking when defining the Policy Issue for the problem and when developing the conceptual model, which often leads to one-sectorial solutions, which may not be sustainable. Furthermore, the duration of some of the ICM processes was prolonged due to disagreement and opposition early in the process and/or lack of manager experiences in conducting a stakeholder participatory process. Finally, due to its stringent structure the SAF was found to be a suitable quality assurance for sustainable ICM processes.

Keywords: Systems approach framework; Stakeholder engagement; Ecological-socio-economic assessment; Policy and science integration; Social ecology

1 Introduction

Integrated Coastal (Zone) Management (IC[Z]M) is an iterative process to promote sustainable management of coastal areas using a multidisciplinary approach. Different initiatives were taken e.g. by the U.S., the United Nations, or the Council of Europe to protect the coastline areas mainly since the 1970s (Vallejo, 1992), but when the ICZM concept progressed in the framework of the Rio de Janeiro Earth Summit in 1992 (Vallega, 1999), this inspired the development of focussed EU policy on ICZM. An EU recommendation to implement ICZM was adopted in 2002 (2002/413/EC), providing a list of principles where integration across sectors and levels of governance is pivotal. Acknowledging the complexities and uncertainties associated with implementing ICZM, a larger four-year EU project SPICOSA (Science and Policy Integration for Coastal Systems Assessment) was launched in 2007 to develop a Systems Approach Framework (SAF) with the objective to restructure research in European countries towards integration of knowledge and methods to support the decision-making process in complex systems characteristic of coastal areas (Hopkins et al., 2011; Mongruel et al., 2011; Tomlinson et al., 2011). However, the complexity of implementing ICM (formerly

termed ICZM) most likely played a role in it being omitted by the time the Maritime Spatial Planning (MSP) Directive (Directive 2014/89/EU) was passed in 2014. The requirements of the directive are limited to the establishment and implementation of MSP by each coastal Member State, although it is also explicitly mentioned that land-sea interactions should be taken into account.

The SAF is a methodological ICM framework that builds on Systems Theory (Von Bertalanffy, 1968). Systems Theory is the transdisciplinary science that investigates the relations within an entity that connect all parts into a whole, rather than reducing the entity into its parts or elements which can then be examined separately. With the SAF a strategy for dealing with issues in a holistic yet stringent manner is described (Hopkins et al., 2011). This has shown to be one of the most influential concepts in ICM practice (Reis, 2014) and that has been applied in numerous case studies worldwide (e.g. Guimarães et al., 2013; Semeoshenkova et al., 2016). The SAF (http://www.coastal-saf.eu/, accessed 15.08.2016) includes integrated assessments of coastal systems to include environmental, economic and social considerations relevant to the issue. The inclusion of social aspects emphasise that humans are part of the system as defined by Berkes and Folke (1998). The interactions between humans and ecosystems are complex, often non-linear relations that may lead to unpredicted responses to external pressures regardless of whether these emerge through ecological, economic or governance drivers. Through simulations of potential policy options including interdisciplinary information, the SAF informs decision-makers of the potential consequences that may help avoid costly damage or negative impacts while simultaneously leading to changes within the social system. These changes may be in user perception of the ecological system or in interactions between different users.

Social knowledge, such as the collective body of knowledge produced by a group of engaged stakeholders, plays a critical role (Berkes and Folke, 1998; Folke et al., 2002). Centrally derived policies attempting to make strong interventions in a top-down manner can inadvertently override locally specific and more appropriate solutions (Næss et al., 2005). The choice of top-down decision making may be due to concerns among managers of dissipating authority. The SAF inclusion of stakeholders enhances the power-governance structure by increasing the mutual knowledge base, common understanding and hence ownership of the decision being made by managers and stakeholders working together (Mette, 2011).

As part of the BONUS BaltCoast project, this paper reports on the findings of 16 re-analysis case studies that were undertaken to test how well the SAF has been applied in recent practice within the Baltic Sea Region. This region is, from a political and administrative point of view, most commonly defined as those nine countries bordering the Baltic Sea, namely Denmark, Germany, Poland, Russia, Lithuania, Latvia, Estonia, Finland, and Sweden. This region has more than twenty years of history in implementing ICM. Early roots are, for instance, the 1996 initiative of the Prime Ministers of the Baltic Sea Region who took the initiative to develop an Agenda 21 (CBSS, 1998), followed by the establishment of a Baltic Sea Region ICZM Platform by major Baltic ICZM actors, international conventions and fora, like HELCOM, Baltic 21, VASAB, the European Commission and national representatives in the year 2003 (Baltic 21 et al., 2003). The region has heavily benefitted from the EU Demonstration Programme on ICZM, various applied projects dealt with aspects of ICM in the BSR over the last two decades, e.g. BONUS BaltCoast, EUROSION, PROCOAST, CONSIENCE, ICZM Oder, ARTWEI, PlanCoast, and AQUABEST (cf. Burbridge, 2004; Körfer and Morel, 2007).

Since many of the ICM elements are included in the SAF they had been addressed in the studies examined. However, the application of the different elements may not necessarily be in the structured and stringent manner ordained by the SAF (http://www.coastal-saf.eu/, accessed 15.08.2016) and summarised in Table 1. The SAF provides a systematic approach to the ICM process, where omitting one of the steps may compromise the development and implementation of sustainable management. In this paper we explore: 1) how many SAF elements were incorporated in the ICM processes of the re-analyses studies examined, 2) whether and how the application of the SAF would improve processes/outcomes, 3) the results of the SWOT analysis of each re-analysis study and 4) whether elements deemed important for issue resolution in the studies are absent in the SAF when re-analysed.

Table 1 The steps in the System Approach Framework (SAF: http://www.coastal-saf.eu/, accessed 15.08.2016). Reiteration between steps can take place at any time. Stakeholders are engaged throughout the process. ESE: see list of abbreviations.

alt-text: Table 1

SAF step	SAF elements within each Step
Issue identification	Identify Policy Issue(s)
	Mapping of Activities
	Institutional mapping
	Stakeholder mapping
	List main ecosystem goods and services

	Identify Social and Economic elements relevant to the Policy Issue
System design	System definition
	Conceptual model
	Data and analytical methods
	Problem scaling
System formulation	Develop ESE sub-models
	Validation and calibration
System appraisal	Generating ESE Systems model
	Calibration and validation and sensitivity tests
	Preparing scenario simulations
System output	Running scenario simulations
	Presenting results to stakeholders
	Conduct stakeholder meeting and management options deliberations

2 Methods

2.1 Case studies

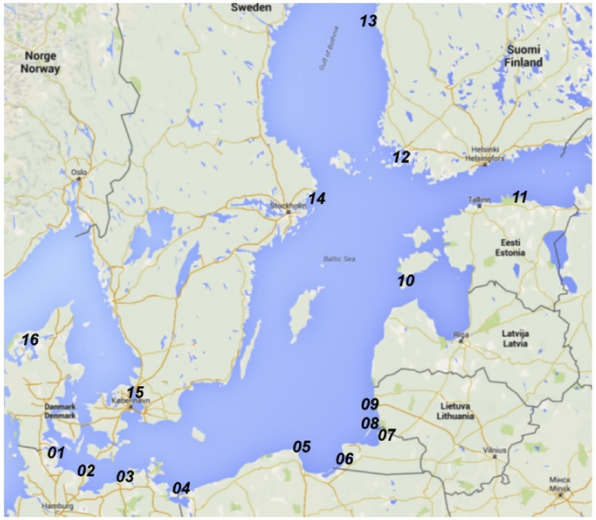
Sixteen ICM case studies were selected in a panel meeting formed by 13 ICM experts from around the Baltic Sea. Most of the experts had been responsible or involved in national OURCOAST case study descriptions and half the selected case studies were taken from the OURCOAST database (European Commission, 2016), a peer-reviewed collection of European best-practice ICM case studies. To include also Russian case studies in the present analysis and to allow for a broad coverage of issues and approaches, the other half of case studies were taken from other local or national initiatives and pan-Baltic projects. The resulting case studies originate from Denmark, Germany, Poland, Russia, Lithuania, Estonia, Finland and Sweden. Key selection criteria were the following: 1) the case study had to address complex coastal management issues which require an ICM-based approach; 2) it should include an advanced process where at least a draft solution has been developed and agreed by the involved actors; 3) it should include a balanced mixture of themes and approaches; and 4) information on both the process and its outcomes had to be available, either as a written documentation or by access to more than one involved key person.

2.2 The analytical approach

According to Burbridge (2004), existing reports from the Baltic Sea Region are not suitable for generic assessments. Therefore, in order to analyse the state-of-the-art of Baltic ICM practice a survey-based approach was chosen. To develop the survey material, which consisted of a questionnaire (Appendix 1), the SAF approach (Hopkins et al., 2011) was taken as a benchmark (Table 1). The survey reviewed the implementation of 67 single ICM steps as described by the SAF Handbook (http://www.coastal-saf.eu/: accessed 15.08.2016) and allowed for additional information, e.g. on reasons for non-implementation, divergent approaches, or participants' observations and comments. Furthermore, the survey included a SWOT analysis (cf. Mintzberg, 1994) on the overall quality of the ICM process (expert judgement) and on external and internal risks and opportunities that may further affect the process (expert judgement). After review of the draft survey material by a panel of national ICM experts (see above), these national experts conducted interviews in local languages with participants of the respective case study processes and consolidated them by summing them up in one completed questionnaire for each case study. The reports were then reviewed and analysed by the authors of this paper.

3 Results

A typology of the main characteristics of the re-analyses case studies listed in Fig. 1 is shown in Table 2. The results of the analyses of the ICM case studies relative to SAF application are shown in Fig. 2. The typology and analyses conducted were used to provide a platform for a thematic evaluation of the results. Each re-analyses case study was ranked according to the number of SAF elements identified in the ICM process and was independent of country (Fig. 3). The high ranking of the two Finnish examples is due to these being strategies and not addressing specific Policy Issues.



Case study sites

01 - Geltinger Birk (DE)
02 - Timmendorfer Strand (DE)
03 - Markgrafenheide (DE)
04 - Szczecin Lagoon (PL)
05 - Hel Peninsula (PL)
06 - Vistula Lagoon (RU)
07 - Neman catchment (RU)
08 - Rusne (LT)
09 - Palanga (LT)
10 - Nasva (EE)
11 - Kunda (EE)
12 - Southwest Finland (FI)
13 - Bothnian Sea (FI)
14 - North Baltic
Water District (SE)
15 - Oresund (DK)
16 - Limfjord (DK)

Fig. 1 The locations of the ICM cases re-analyzed indicated by name and listed on the left-hand side of the map of the Baltic Sea.

alt-text: Fig. 1

Table 2 Typology of the main characteristics of the re-analyses case studies.

alt-text: Table 2

Rank	No	ICM case study	Country	ICM process initiated by	ICM driver(s)	Issue type and complexity	Issue identified at outset	Institutional and stakeholder mapping	The ICM team composition	Stakeholder engagement	Economic assessment	System assessment (ESE model)	Scenario simulations	ICM tim scale
15	1	Coastal realignment and wetland restoration Geltinger Birk	Germany	Federal state ministry	Ecological, economical (costs of coastal protection)	Coastal protection & nature conservation	Yes	No mapping	Authorities, local managers & stakeholders	Several thematic groups, engaged during process	Combined cost analysis of restoration and protection	No	No modelling, several management scenarios	>20
9	2	Coastal protection & wetland restoration Markgrafenheide	Germany	Regional authority	Ecological, economical	Coastal protection & nature conservation	Yes	No mapping	Local & regional authority representatives	Only public participation meetings	Two sectorial cost analyses	No	Modelling of coastal evolution; no alternative scenarios	>10
15	3	Coastal protection management:	Germany	Federal state ministry	Economic (flooding, tourism)	Coastal protection, tourism & urban development	Yes	No mapping, multiple stakeholders	Local stakeholders with moderator (company	Engaged at outset of process	Sectorial cost analyses	Yes	Yes, qualitative model	>10

		Timmendorfer Strand & Scharbutz						and institutions identified	contracted~~contrated~~ by ministry)		(coastal protection)		including all ESE components	
6	4	Hel Peninsula	Poland	National managers	Economic (local population and tourism)	Climate change (beach erosion)	Yes	No mapping	National mangers & scientists	Bilateral or small groups, engaged during process	One-sectorial cost analysis	Bio-economic model	Yes	>10
14	5	Szczecin lagoon - Polish part	Poland	Local managers	Economic	Climate change & Natura 2000	Yes	No mapping	Local managers, no formal team	Bilateral or small groups, engaged during process	One-sectorial cost analyses	No	No	>10
1	6	Limfjord-Denmark	Denmark	Scientists	Ecological	EU WFD implementation	Yes	Yes	Scientists, national managers, stakeholders	Engaged at outset of process	Cost-effectiveness	Yes	Yes - bio economic modelling, multiple cross sectorial scenarios	<5
16	7	Sound- Denmark	Denmark	Stakeholders	Economic	Natural resource use conflict	Yes	No mapping	No	No	No	No	No	<2.5, bu unresolv
12	8	Restoration of important habitat through sustainable agricultural practices, Rusne	Lithuania	National NGO	Ecological	Nature conservation & sustainable agricultural practises	Yes	No mapping, multiple stakeholders and institutions identified	National NGO's, local managers, local stakeholders, social scientists,	Engaged at outset of process	No	Partial model. non-quantitative inclusion of other ESE components	Ecological scenarios	<10

13	9	Integrated shoreline management for a large harbour city, Klaipeda Seagate and an adjacent seaside resort Palanga	Lithuania	National managers	Economic	Climate change (beach maintenance/tourism)	Yes	No mapping, multiple stakeholders and institutions identified	National managers, local managers, scientists, local stakeholders, NGO's	Engaged at outset of process	No	No	No - lack of modelling expertise	<2.5
8	10	Cross-border Neman River Catchment - Russian part	Russia	National & local managers	Ecological	Water quality protection	Yes	No mapping, multiple institutions identified	National and local managers, scientists, stakeholder interests addressed by professionals	Bilateral or small groups, engaged during process	No	Ecological model component	Ecological scenarios	
5	11	Vistula Lagoon – comprehensive management of a water body	Russia	National managers, cross-border (Russia-Poland)	Ecological & economic	Water quality protection	Yes	No mapping	National managers, local managers, scientists, stakeholder interests addressed by professionals	No	Yes	Bio-economic modelling	Economic and ecological scenarios	>10
10	15	The Järve-Nasva case-study site on Saaremaa island – coastal protection	Estonia	Local managers	Economic	Climate change, HA and nature conservation	Yes	No mapping, multiple stakeholders identified	Local managers, local scientists, local stakeholders, NGO's	Engaged at outset of process	No	No.	Spatial assessment of human activities	>10
7	16	Kunda Port development	Estonia	Stakeholders	Economic	Coastal development, resource use & nature conservation	Yes	No mapping, multiple stakeholders identified	Port authorities, other local managers, nature protection representatives, scientists, local stakeholders	Engaged at outset of process	Yes - one-sectorial costs	Ecological models (based on historical data)	Scenarios based on historical data	<2.5

2	17	Coastal management strategy for southwest Finland	Finland	Scientists	No ICM driver	No issue identified	ICZM/MSP development	No mapping, multiple stakeholders identified	Regional managers, scientists, multiple stakeholders	Engaged at outset of process	Yes	No.	Spatial assessment of human activities and nature resources and values	n.a.
3	18	ICM in the Bothnian Sea, western Finland	Finland	Scientists	No ICM driver	No issue identified	ICZM/MSP development	No mapping, multiple stakeholders identified	Regional managers, scientists, multiple stakeholders	Engaged at outset of process	Yes	No.	Spatial assessment of human activities and nature resources and values.	n.a.
11	19	Implementation of the WFD: The North Baltic Water District in Sweden	Sweden	National managers	Ecological	EU WFD implementation	Yes	No mapping, multiple stakeholders and institutions identified	National managers, scientists consulted	Engaged at outset of process	Yes, cost-effectiveness	Partial economic assessment at national level.	No	

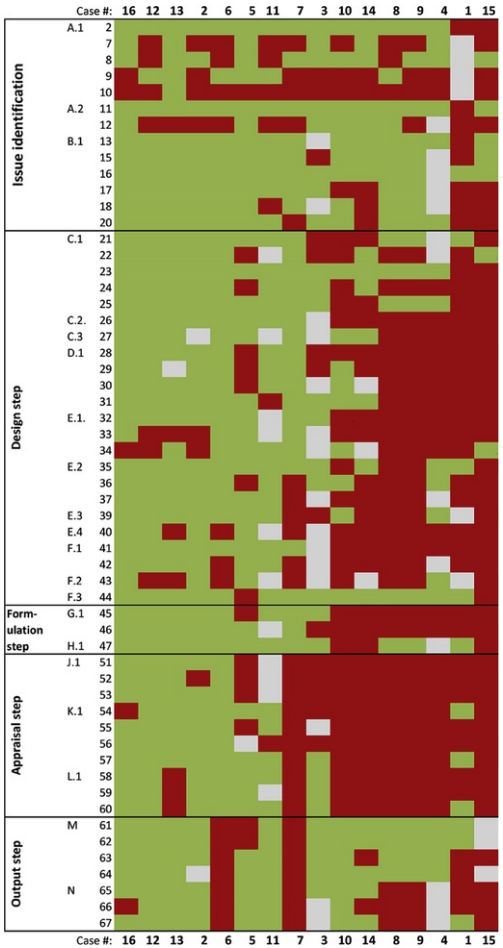


Fig. 2 Matrix indicating whether a SAF element has been implemented (green) or not (red). Grey fields: no answer was given or respondent was uncertain; x-axis: case study number, cf. Fig. 1 or Table 2; y-axis: SAF steps with block and question numbers a used in the questionnaire, cf. Annex 1. Only 56 of the 67 questions are represented in the matrix as only those questions that could be answered as “Yes”, “No” or “Do not know” could be included. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

alt-text: Fig. 2

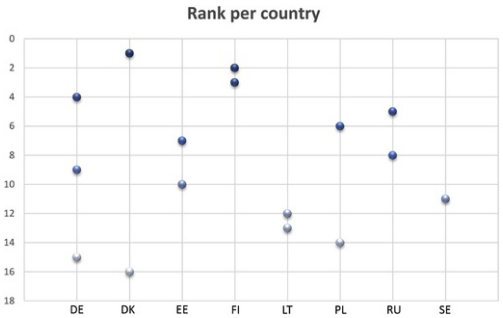


Fig. 3 Rank per country. Each re-analyses case study was ranked according to the number of SAF elements identified in the ICM process.

3.1 Policy Issues and issue driver

The main ICM driver was either ecological (7; 44%) or economic (7; 44%) (Table 2). The main issues were the needs for coastal protection or realignment (8; 50%) due to impacts from climate change or coastal development needs (Table 2). Four case studies (25%) dealt with eutrophication issues or were related to water quality. Two case studies dealt with general proactive ICM planning with no specific Policy Issues. The secondary issues were tourism and nature conservation. Three case studies dealt with spatial conflicts in human activities either as primary or secondary concerns. Eleven (69%) of the ICM processes were led by national managers and thus top-down, of which six (38%) were related to implementation of EU legislation (Fig. 2). Of all the case studies, 25% of them were initiated by stakeholders, which ensured their participation in the ICM process. In almost all case studies (88%) a core group (Management Team) was established to deal with the Policy Issue (Fig. 2) but only in two of the cases was there knowledge of the SAF.

3.2 Institutional and stakeholder mapping

Institutional mapping was reported for six (38%) of the case studies (Fig. 2). From the descriptions it was evident that only one performed a formal institutional mapping (Table 2), whereas in the rest of the cases relevant institutions were identified by the responsible ICM authority. Several Baltic countries reported top-down processes with inclusion of some or most of the stakeholders. Several case studies (9; 56%) reported that none of the stakeholders were omitted, but formal mapping was not carried out. In some case studies (5; 31%), participation was limited to managers and relevant scientists. Several case studies (9; 56%) included stakeholders at the outset as specified by the SAF, whereby stakeholders are involved in the formulation of the Policy Issue (Issue Identification).

3.3 Background information relevant to the issue

Most case studies reported good research into the cause and effect chain, identification of pressures and economic, ecological and social aspects related to the Policy Issue (Fig. 2; Design Step). Less than half the cases had developed a Conceptual model for the ICM Issue important in the Systems Approach. This is further reflected in the lack of consideration of data requirements and availability, and the lack of an integrated modelling strategy in most cases.

3.4 Ecological-social-economic (ESE) modelling and scenario simulations

Few case studies performed a full integrated ESE assessment, where ecological, social and economic components were quantified and integrated into a model (Fig. 2; Formulation Step). Most (75%) had calculated costs for the potential solutions. Several included bio-economic models to provide the bases for simulations of management scenarios. Most case studies (75%) used scenarios for management options, although only half (8) used quantitative modelling methods for simulations of scenarios (Fig. 2; Appraisal Step).

3.5 Stakeholder involvement in the decision process

There was a high engagement of stakeholders in the discussions (75%), with stakeholder opinions being taken into account (56%), despite a low frequency (38%) of the use of formal Decision Support Tools. This suggests that half the case studies were top-down driven and the decision was not influenced by stakeholder opinions. The latter became visible also in separate analyses of strength, weaknesses, opportunities and threats (SWOT) that were conducted for 15 of the ICM cases. While the evaluators valued most of the strength-weaknesses test criteria as strengths, nearly all those criteria that refer to active stakeholder involvement were considered as being imperfect (Fig. 4). According to Fig. 2 there was a high engagement of stakeholders in the discussions (see above), but on average the reviewed case studies had some shortcomings in

- involving stakeholders in a review of ESE assessments,
- making use of local knowledge,
- active involvement of stakeholders,
- sufficient space for discussions, and in
- providing transparent results and decision making processes.

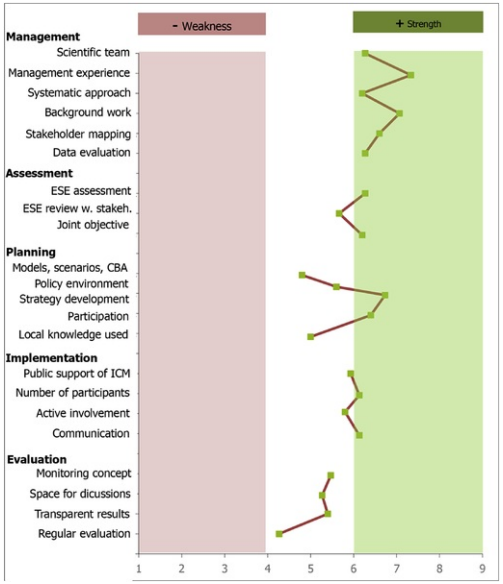


Fig. 4 Average values for strengths and weaknesses of 15 ICM case studies.

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3.6 External forcing and evaluation

Few case studies reported on the success of the ICM process and this is therefore not dealt with here. Linked to this is the problem that often there is no regular evaluation of an ICM process (Fig. 4.). Several of the case studies reported on the duration of the ICM process. Six lasted more than ten years and reported stakeholder fatigue. In addition to top-down approaches this could be another influencing factor for the shortcomings in active stakeholder involvement. Three reported short ICM processes (<2.5 years), but one is still unresolved. Political changes with subsequent changes in the national management structure had, in at least two cases, disrupted the ICM process or resulted in the lack of implementation of SAF results. An unsupportive policy environment was in many cases perceived as having negative impacts on the reviewed processes (Fig. 4).

Legal certainty was recognised as the dominant opportunity in ten of the ICM case studies where EU or national legislation empowered national managers to drive the ICM process (Fig. 5). Funding and Public opinion and interest were viewed as opportunities in six cases and threats in seven. Climate change and economic change were recognised as threats in more than half the cases. Political change and speed of implementation were identified as threats to the ICM process in the majority of the cases (12; 75%). There were few responses to the potential threat or opportunity of institutional change (3 for each choice).

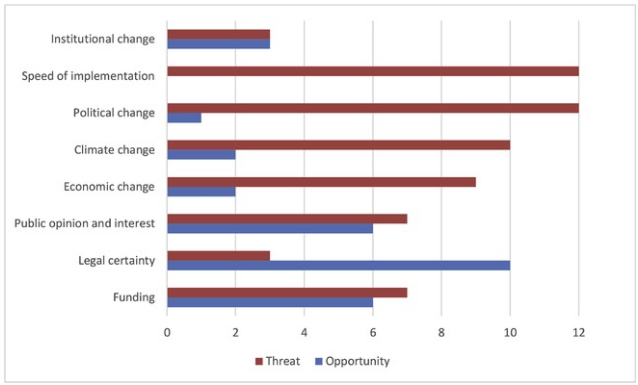

Fig. 5 Opportunities and threats by number of mentions.

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4 Discussion and conclusions

This study revealed that several ICM elements as defined by the SAF are already standard within the Baltic Sea Region, e.g. environmental impact assessments, access to information, and public participation. This, however, is of little surprise as it simply shows compliance with international conventions, e.g. the Aarhus Convention and Espoo Convention, as well as European law, e.g. EU directives 85/337/EEC (and its later amendments), 2001/42/EC, and 2003/35/EC. However, omission of a comprehensive stakeholder and institutional mapping at the outset of an Issue Identification may compromise the success of ICM because the power and influence interactions are not fully understood. Systems thinking (i.e. holistic approach) is integral to an ICM process, but most of the case-studies re-analysed dealt with one-sectorial solutions, indicating that holistic approaches were, in effect, rarely implemented. Furthermore, the duration of a successful ICM may need to be within a political timeframe.

4.1 Systems thinking in ICM processes

Most of the ICM processes reviewed failed to include an integrated cross-sectorial, ESE assessment and scenario simulations were limited to one-sectorial solutions. This derived from the reactive ICM response in dealing with a specific problem or the implementation of a directive. This resulted in the Policy Issues being decided on without considering the entire system as upheld by Hopkins et al. (2011). The inclusion of a broader stakeholder consultation at this point would have ensured the consideration of activities, processes and interactions within the entire system in which the problem is embedded. The ICM processes focused on identifying solutions to a particular problem. Sustainable ICM requires systems thinking to prevent that solutions to a particular problem give rise to new problems or cascade effects. An example is the implementation of the Water Framework Directive (Dinesen et al., 2011). Without stakeholder consultation at the outset this would have focused on up-stream and down-stream mitigation of nutrient loadings. With the institutional mapping and stakeholder consultations other states and activities that would be affected by the solution were identified and included in the ESE assessment (Dinesen et al., 2011).

4.2 Stakeholder engagement

Public opinion and interest were viewed as both an opportunity and a threat to the ICM process in the Baltic cases. In recent decades, there has been a paradigm shift in the hegemony of opinion and decision making to take on more seriously the input of citizens in recognition of the fact that citizens have to live with the decisions and the outcomes. Bookchin (1982) conceptualised social ecology as a critical theory that integrates environmental, social and economic aspects for sustainable management. This has developed into a paradigm for sustainability thinking as demonstrated in Fig. 6 (Adams, 2006).

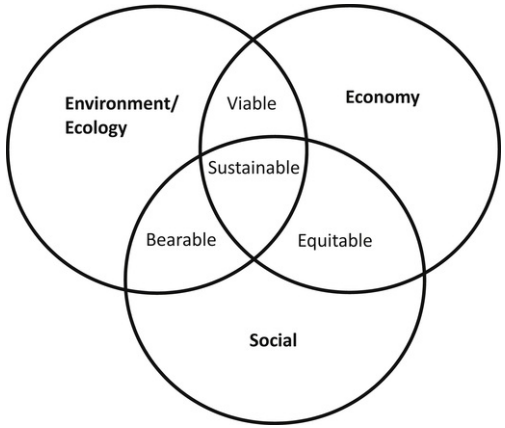

Fig. 6 The three pillars of sustainable development developed by Adams (2006), adapted by J. Dréo (https://commons.wikimedia.org/w/index.php?curid=1587372) and redrawn here.

alt-text: Fig. 6

However, without a robust governance framework that has integrity and the participation of citizens a shared future cannot be built (Fig. 7). Meaningful benefits from community participation can only be achieved by a genuine commitment by the ICM process leader (Robinson, 2002). The SAF respects the complexity of integrated systems and processes and the multiplicity of perspectives enriched through citizen participation. The stakeholders are engaged from the outset of the process in defining the issue, describing the virtual system, choosing potential management options and at the end of the process discussing results of scenario simulations. It is vital for citizen compliance that stakeholders have the opportunity to discuss several management options before implementation. The SAF recognises the pivotal role of a robust governance system prepared to conduct an open, transparent and accountable ICM

process that encapsulates citizen input and ensures their trust. The continuous engagement of stakeholders in the ICM process is helpful in building trust and common understanding (Dinesen et al., 2011; Franzén et al., 2011; Hopkins et al., 2012; Konstantinou et al., 2012). The achievement of citizen trust, in turn, reduces the risk of consultation fatigue. This aspect was lacking in many of the Baltic cases. Several followed traditional decision making by managers on course of action, who to include, and public hearing to inform on decisions, thereby excluding the process of trust-building, mutual education and joint problem solving between managers and citizens.

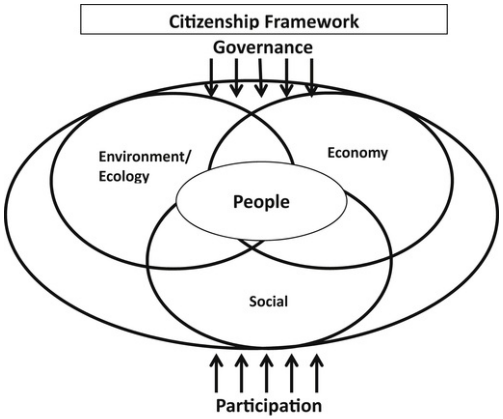

Fig. 7 The Citizenship Framework depicts how the three pillars of sustainability must be integrated with citizen participation and embedded in a robust governance framework.

alt-text: Fig. 7

Identification of the appropriate stakeholders is a critical first step for a successful ICM process (Biggs and Matsaert, 1999; Pomeroy and Douvere, 2008), which is why stakeholder mapping has a high priority in the SAF. Different perceptions of who the stakeholders are were evident in the ICM case studies reviewed. In some, experts or civil servants representing specific trades, human activities or nature interests were considered as the appropriate stakeholders by the management team, whereas in other case studies, individual local citizens/stakeholders were actively involved. Stakeholder and institutional mapping is an important tool that explores links between key actors who have power to make decisions and those who have political or economic influence (Mcfadden et al., 2010). Lack of formal stakeholder and institutional mapping in the Baltic cases led to imbalanced stakeholder groups that did not represent all interests, while motivated opponents had a field day. The inclusion of individual stakeholders with strong opinions may hamper collaboration due to large discrepancies in issue perception and system understanding between managers, scientists and other stakeholders (Human and Davies, 2010). The results of this study showed that effective stakeholder participation was hampered by 1) lack of regulations on formal stakeholder involvement from the onset of the process, 2) lack of experience by managers, and 3) lack of mapping and consultation tools.

Stakeholders who foresee a negative economic consequence for their activities and simultaneously have a strong political influence (e.g. lobby) may choose not to be involved in an ICM process. This is an important weakness in ICM and also in the SAF because stakeholders cannot be forced to participate and potential solutions discussed may be totally ignored in the political aftermath as was shown in one of the case studies. One possible way to counter the effects of a politically strong but un-engaged stakeholder is to ensure strong community participation in an open and transparent process. An ESE assessment may help increase local knowledge on ecological and socio-economic consequences and help identify mitigation strategies that are more acceptable to the entire community. In such situations a robust ICM process should be grounded in principles of good governance (i.e. accountability, transparency and openness). In very complex matters, it may be useful to employ consultants skilled in high social risk management to develop the appropriate methodology for engagement.

4.3 Conceptual model and ESE assessment

A conceptual model is a descriptive representation of a system that helps visualise the components, processes and interactions relevant to a Policy Issue to help participants know and understand entities and relationships between them. Conceptual models appear to be an intuitive part of the ICM process. Most Baltic case studies reported some form of conceptual model, but had not fully appreciated the value of considering the entire system (Fig. 6). This resulted in one-sectorial perceptions of the system ignoring that complex ESE interactions may give rise to unforeseen results and cause undesired consequences (Hopkins et al., 2011). In the SAF, conceptual models are used to describe all the states, processes and links within and between the ESE components (http://www.coastal-saf.eu/: accessed 15 Aug 2016). Conceptual models help to identify external forcings and provide a structural description of the virtual system. With the conceptual model at hand the decision of whether to develop quantitative models or use other methods relies on three questions: 1) Is the issue simple? 2) Are the risks low? and 3) Do we have sufficient information to make reliable scenario simulations? If one can answer yes to all questions, development of a quantitative model may not be necessary.

The level of complexity and risks involved determines the level of participation required by the community (Robinson, 2002) and the type of participation needed and methods to be applied. Integrated quantitative ESE modelling is essential where complex interactions are involved and sufficient data is available. This allows for the evaluation of consequences of different management options. In two Baltic case studies, available hindcast data was insufficient for predictive quantitative modelling thus decision making relied on consultative meetings towards unanimous recommendations of management options. In such cases, the ESE assessment can be shortened by omitting the System Formulation and System Appraisal steps. Where data is available, tools such as quantitative models (Hopkins et al., 2012), MSP and GIS, can be combined with qualitative information and new knowledge generated through different public engagement methods, depending on the issue complexity and level of risk involved (Robinson, 2002). The involvement of the public in the process provides a learning platform for the core group. Furthermore, the modelling provides deliberation support incorporating multiple objectives and disciplines, deals with limited data and different types of information and collates ICM data (Ballé-Béganton et al., 2010). Thus, the SAF is sufficiently flexible to allow ESE assessments to be carried out at different information/data levels (Hopkins et al., 2012).

Economic change may arise unexpectedly, locally, nationally or on a global scale, requiring immediate interventions. It is therefore reasonable that this was identified as a threat in more than half the Baltic cases with an identified issue. Especially with economically driven Policy Issues, the value of the ESE assessment emerges. The reviewed ICM case studies focused on calculating direct costs of different interventions for one sector only and social aspects were largely ignored. The one-sectorial approach risks neglecting impacts on other sectors or the environment in an unpredicted fashion. The solution may be viable or equitable but not sustainable (Adams, 2006).

Funding provides the opportunity to include resources necessary to complete an ICM process and implement decisions. In the Baltic studies, funding was considered to be an opportunity if available but also a threat to the ICM process when lacking. When funding was used to outsource the tasks to consultancy agencies, not all stakeholders were included. This may have resulted in solutions that were not embraced by the end users but the case studies did not provide information on this aspect.

4.4 Legal certainty and implications of ICM not being in a legal framework

Legal certainty was the most frequently identified opportunity reflecting the role international directives have played in ICM processes in the Baltic region. The EU WFD and Natura 2000 directives (European Commission, 1992, 2000, 2009), among others, have been important drivers towards environmental protection and abatement of undesired state of nature at national and cross-border levels. The directives empower managers to address environmental issues but do not necessarily capture the need to 1) involve citizens until late in the process and 2) address cross-sectorial and multidisciplinary issues in an integrated approach.

Cross-sectorial assessments require that there is a legal framework in place but it seems to be missing in most of the reviewed cases. In Germany, existing legislation might even prohibit cross-sectorial assessments. The German Environmental Impact Assessment Act in conjunction with the Guidelines for Execution, which are the national transpositions of the European Environmental Impact Assessment and Strategic Environmental Assessment directives (EIA - 2014/52/EU; SEA - 2001/42/EC), state explicitly that economical, societal, or social impacts shall not be considered within environmental assessments. There is no other legal basis for a Social Impact Assessment (with the exception of brown coal mining in North Rhine-Westphalia), wherefore social and economic impacts are often disregarded.

In 2002, the EU recommended the implementation of ICM, providing a list of principles.(should not be a new paragraph here.)

In ensuing negotiations, probably due to the complexity of implementing ICM, the resulting directive (MSP Directive 2014/89/EU) only included the MSP framework with a limited application on land-sea interactions. Thus, some of the eight EU ICM principles may have been ignored, such as the long-term perspective, adaptive management, local specificity, working with natural processes and the support and involvement of relevant administrative bodies. Sustainable growth in Europe would thus benefit from a legal driver towards a better quality in ICM processes.

4.5 Process duration

Identification of political change and speed of implementation as threats to the ICM process in the majority of the Baltic cases reflects the need to have a structured ICM framework and a timeframe aligned to the political cycle. Two cases showed a direct impact on implementation due to change in governance. In one case, a national institutional restructuring during the end of the SAF process (i.e. at the Output step, Table 1) changed the power structure and the managers involved were no longer relevant. The Science-Policy decoupling halted the process and implementation never took place (Dinesen et al., 2011). In the other case, a recent shift towards higher stakeholder involvement was interrupted due to a change in government and political direction (Sørensen et al., 2016). To ensure implementation of management options based on a SAF process, this should ideally be completed within one election period. It may also be possible to gain broad political support at the outset of a process in cases where a longer implementation time frame is required. This may require including multi-partisan political stakeholders, apart from securing funding and resources for the complete process.

In several of the Baltic case studies, the ICM processes lasted for multiple years (Table 2). This was due to 1) lack of initial involvement of stakeholders, 2) lack of trust between citizens and managers, and/or 3) lack of experience in conducting the ICM process. This indicated the importance of completing the Issue Identification and System Design steps in a structured and coherent manner and of demonstrating leadership to embrace dialogue both

within and outside institutions. Long planning and implementation periods seemed to be a systematic challenge in ICM processes. This increased not only the probability of changes in external drivers but also affected willingness of stakeholders to participate (consultation fatigue). This constitutes a risk to completion of a successful ICM process, since exclusion of the Systems Output step prevents stakeholder deliberation on different management options.

Global concerns on climate change are highly emphasised in the coastal zone where major changes are most likely to occur and which are the most densely populated areas (Cox et al., 2000). This ecological driver has many social and economic implications. Furthermore, the time frame of changes may differ from a gradual process to sudden irreversible changes. The reviewed case studies reflected a variety of these concerns ranging from inundation problems to coastal protection or development impacting different economic sectors and public perception and use of coastal resources. Therefore, the process oriented approach recommended in the SAF is vital when considering management solutions to climate change issues.

4.6 Analytical shortcomings (reviewers based)

The assessment area that was used for this study, the Baltic Sea Region, is a heterogenic area formed by nine countries with a corresponding diversity of languages, cultures, and legal and administrative systems. To get access to local processes and documents as well as to classify them with the context of national peculiarities, the involvement of national experts was necessary. Although the experts filled in the questionnaire based on interviews, we cannot exclude bias interpretation. Individual national experts may have had different types of relations to interviewees or they may have categorized information in different manners. Although the re-analyses could be highly subjective, much of the extracted information from the questionnaires was coherent and provided a critical reflection on past ICM processes and where these can gain from SAF assimilation in future processes.

The standardized questionnaire followed widely the SAF steps as outlined in the SAF manual (http://www.coastal-saf.eu/: accessed 15.08.2016). However, at the time of the re-analyses the SAF was novel to many of the experts. In the self-evaluation some of the questionnaire respondents indicated that they had difficulties in describing all process details within standardized text fields, while they acknowledged the necessity for comparable systematics.

Two Finnish studies were included in this analysis, even though they did not fulfil the criteria of addressing a specific Policy Issue. These studies described strategies for ICM in specific areas in a manner that was well aligned with the SAF approach, and thus scored high in the country ranking in implementation of SAF element. However, because no specific policy issue was being addressed the potential for negative environmental, social and economic impacts was low with no perceived conflict of interests. The challenges in the ICM process are: 1) communication especially when the stakes are high (Robinson, 2002), and 2) the Policy Issue involves a complex system (Hopkins et al., 2012).

4.7 SAF manual improvement

In many case studies, the participatory stakeholder involvement process was not well developed or not successful. Local experts gave various explanations, like lack of time, resources or experience. A major problem was the balanced involvement of all stakeholders and dealing with opponents. Therefore, tools that support the participation process are important in the SAF and need to be linked to indicator-based assessments. It should allow a more systematic, guided and thematically focussed stakeholder involvement process.

Our experience shows that success and implementation process of ICM measures most often are not sufficiently evaluated. Therefore, we support the suggestion by e.g. Pendle (2013), who recommends that key performance indices of sustainability should be developed, included in predictions and thereafter monitored to provide evidence that measures meet economic, social and environmental sustainability goals. Another important aspect is the joint definition of success criteria and indicators in the beginning. We even should go further and provide a sustainability indicator tool that allows a comprehensive assessment of the situation before and after the measure. The application of this tool in the beginning to assess alternative hypothetical scenarios can help to raise awareness and to visualize consequences of decisions including status quo scenarios. Further, a post survey among stakeholders would be important to assess the acceptance of a measure, because we saw several times that the acceptance changed (usually improved) several years after the implementation. An indicator based pre-and post-assessment allows a systematic compilation of lessons learnt for future case studies and avoids repeating mistakes. However, it requires the provision of tools needed that allow fast assessment without detailed expert knowledge.

4.8 Perspectives - how can SAF improve an ICM iterative process?

Policy effectiveness implies sustainable resource management rooted in systems thinking. Sustainable management builds on three pillars: environmental, social and economic elements. These elements need to be integrated within a framework of public and stakeholder participation and a robust governance system. This study highlighted the need for national and international frameworks to ensure legal certainty in holistic approaches. The study also showed that committed leadership and the necessary resources are required for a timely and effective ICM process. Furthermore, stakeholder participation needed to encompass all relevant parties and be engaged from the outset right through to the implementation stage. This would ensure that decisions are fully transparent and accountable. It would also ensure citizen ownership of issues and outcomes, which is the best guarantee for compliance. Education is an important step to broaden knowledge of the SAF and ensure its implementation in the next generation managers, scientists and stakeholders. The SAF provides the structure to encompass all the above. Due to its stringent structure the SAF is a suitable quality assurance for sustainable ICM processes.

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Appendix A

Table A.1 This questionnaire provided opportunity for answering "Yes", "No" or "Do not Know" to 56 of the 67 questions. There was space for comments and for some questions additional information was provided (here in brackets). The questions were based on the SAF handbook (http://www.coastal-saf.eu). The omitted questions were those requesting descriptive information on the case-study.

alt-text: Table A.1

Pre-check Q:1	Is this case-study dealing with a complex issue (e.g. affecting multiple human activities or multiple stakeholder groups), which requires the use of a systematic management approach? If not, you might wish to choose another case study.
A.1	**Issue Identification - getting started**
2	Was a management team built to lead the process and did it have scientific competences to some degree?
7	Was the issue initiated by EU directives?
8	Was the issue initiated by national regulations?
9	Was the issue voluntary initiated by stakeholders?
10	Were the team members familiar with SAF?
A.2	**Issue Identification- preliminary study of the coastal zone**
11	Were human activities (HA) and associated stakeholder groups determined?
12	Was a preliminary institutional map created to show up the relation between the governance and these HA and stakeholders?
B.1	**Issue Identification – reach agreement on the Policy Issue**
13	Was a reference group formed? (consisting of stakeholders, environmental managers and/or policy makers)
15	Was the issue discussed and agreed by the reference group?
16	Was background work done? (Analysis of available information on the cause-and-effect chain from HA to impact and evaluation of the importance of different HAs and impacts)
17	Where all possible measures and their costs and impacts identified?
18	Was equity, or allocation of effects among stakeholders, given any concern?
20	Were the main economic activities, the main ecosystem goods and services and the main economic drivers listed or mapped?
C.1	**System Design – definition of the Virtual System**
21	Was the cause-and-effect chain described? (Description of the chain from HA via ecosystem dysfunction to Impact that is involved in the problem)
22	Was the virtual (eco) system around the cause-and-effect chain visualized by mapping? (List of the main ecosystem components, and their main links, to be included in the Virtual System relevant to the 'Issue')
23	Were the main ecosystem components listed?

24	Were the transboundary exchanges (e.g. with adjacent seas) which should be included in the system listed or mapped?
25	Were the economic and social components included in the virtual system?
C.2	**System Design –identification of external hazards**
26	Were the external hazards listed which pose a risk for the real system in relation to the issue?
C.3	**System Design –synthesize the state of the impacted system**
27	Was a synthesis of the system state made?
D.1	**System Design – construct conceptual models**
28	Was a method found to construct a model on the virtual system?
29	Were conceptual models prepared? (By drawing or software? Graphical symbols and connectors and a means for assembling these are necessary (e.g.: http://www.coastal-saf.eu/design-step/examples)
30	Was the reference group involved in developing conceptual models?
31	Was modelling required to solve the issue/problem of this case study? If not, please explain briefly why it was not required and after that continue with line 100. If yes, please continue with line 92.
E.1	**System Design –identify model software, methods and formats**
32	Was a strategy for the modelling developed? (Were available models adapted? Were new sub-models for the virtual system simulation model developed?)
33	Were auxiliary models identified to be used?
34	Were other tools identified and used? (e.g. GIS or tools for statistical analyses)
E.2	**System Design – analysis of the economic dimensions of the Coastal Zone system and identification of suitable economic assessment methodologies**
35	Were costs calculated and compared for different actions?
36	Were assessments made of impacts on different stakeholders?
37	Were the economic dimensions of the models clear and explicit?
E.3	**System Design –acquire data**
39	Were relevant human activities identified and relevant ‘pressure’ or ‘forcing’ data acquired?
40	Was there a strategy for the issues of missing data and uncertainty?
F.1	**System Design –adjust the complexity of the Virtual System**
41	Was the complexity of the Virtual System adjusted (e.g. by focusing on core processes, by idealization, or by setting up a problem-oriented model)?
42	Was the feasibility of the implementation ensured?
F.2	**System Design – specification of formats for results**
43	Did the reference group think about a format for the presentation and visualizations of results?
F.3	**System Design –designed system report**
44	Was a technical reporting document compiled?
G.1	**System Formulation-modelling**
45	Was/were the model/models actually used with the case study work?

46	Were links between different model components (e.g. hydrodynamic, bio-ecological, social, and/or economic models) identified?
H.1	**System Formulation-scenarios**
47	Were scenarios used to inform the case-study process and/or to run the models?
J.1	**System Appraisal- preparation of the ESE models for coupling (ESE: Economic, Social, Ecological)**
51	Were the ESE models checked concerning the appraisal objectives?
52	Were other links to other models or products of analyses integrated?
53	Were the ESE models run separately for purpose of interpretive analyses?
K.1	**System Appraisal-system simulations**
54	Were the priority and feasibility of scenarios reviewed and evaluated?
55	Were necessary input data for selected scenarios generated?
56	Were different scenario versions of the Simulation Model prepared, conducted and tested?
57	Were the results of scenarios documented?
L.1	**System Appraisal-output preparation**
58	Were the Hindcast and Scenario modelling results described and interpreted?
59	Were limits and liability of the model document within the analysis?
60	Were draft conclusions from the simulation analysis made and provided to stakeholders?
M	**System Output- hold a stakeholder forum**
61	Was a Stakeholder Forum organized?
62	Was a report of the forum drawn?
63	Were the results of scenarios/their interpretation discussed with stakeholders?
64	Were the outcomes of the stakeholder forum/hearing considered by the overall decision making process?
N	**System Output-deliberation**
65	Was a deliberation forum prepared?
66	Were decision support tools used for deliberation on the issue(s) of this case study?
67	Was the deliberation reflected by the stakeholder group/had participates the opportunity to add comments?

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Highlights

- The SAF is highly suitable as quality assurance for sustainable ICM.
- Omitting stakeholder and institutional mapping may compromise the success of ICM.
- Several reviewed ICM processes were not holistic in their approach.
- With SAF an ICM process may run more effectively, within a political timeframe.
- Quality in ICM processes would benefit from the establishment of formal directives.

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