

Coastal adaptation to climate changes through an Integrated Coastal Zone Management approach: from theory to practice

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Abstract

- **Purpose:** Some of the major issues within an ICZM concept, including climate changing parameters, seek answers to the following questions: how to allocate coastal resources in order to maximize their efficiency, how to assess the impact of decisions, how to evaluate alternatives or decision-scenarios and how to select the best available solutions. It is essential to implement a decision support method. One of the problems, however, is that decision support methods are usually too sophisticated, complicated to non-familiar users, time consuming, and they demand highly accurate datasets. Thus, it is often the case that decisions on coastal issues are taken without the necessary integrated decision support framework.
- **Method:** This paper presents the new developed decision support method DeCyDe-4. It is a highly participatory, site- and problem specific method, with a strong gamification character, to make it attractive to use. A “scoring” approach (scoring through ranges) is incorporated, transforming the parameters that describe the problem into decision criteria.
- **Results:** DeCyDe-4 method provides the decision makers and the professionals with the framework, the overall picture, to understand and justify the main issues that are involved in the process of decision-making and the trade-offs between different decision alternatives. It is a numerical prognosis of the possible impacts that each change can have to the entire “picture” of the targeted aim, with a numerical assessment of each new state/condition, incorporating all kinds of changes.
- **Conclusions:** Easy to use, participatory and robust decision support tools are a step towards the effective adaptation process.

Key words: coastal adaptation, decision support, coastal zone management, resource efficiency

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1.0 Introduction

In 1992, in Rio de Janeiro, the United Nations Conference on Environment and Development (UNCED) defined a number of “*critical uncertainties*” that should be urgently addressed by governments, in view of the dramatic declining of our planet’s natural resources. Integrated Coastal Zone Management was highlighted as a need for the future of the planet’s coastal zones.

Twenty years after this urgent call, Integrated Coastal Zone Management is still a need for the planet's coasts and it is still a field of controversy. This narrow strip, in between the land and the sea combines terrestrial and marine impacts. Achievement of both terrestrial and marine resource efficiency is needed, being at the same time an area of high interests and a sky-rocketed development asset, especially for touristic European areas. All these inherent and complicated characteristics, coupled with the emergency to respond and adapt to climate changes made coastal system and coastal related decisions even more complicate and difficult. Rational management is a necessity and practice is an urgency.

Some of the major issues within an ICZM concept, including climate changing parameters, are to answer the following questions: how to allocate coastal resources in order to maximize their efficiency, how to assess the impact of decisions, how to evaluate alternatives or decision-scenarios and how to select the best available solutions. It is essential to implement a well structured, site specific decision support method in order to serve decision takings and implementation.

Decision-making in a public policy context is a complex issue that requires the simultaneous management of a multifaceted problem and of the decision-making process itself, which is often compounded by the conflicting objectives of the various participants (Van Groenendaal, 2003). The factors that influence public policy decision making are becoming increasingly numerous and complicated, and there is a recognized need to move away from a purely conceptual and theoretical approach to a more pragmatic one based on empirical evidence. More accountability is now required in governmental and societal decision-making (Harris, 2002). It is therefore not surprising that decision support systems are becoming ever more important in public policy-making.

One of the greatest shortcomings of many decision support tools is that they are designed in a very sophisticated way, with high complexity, ignoring the fact that not all public policy decision makers have high academic competencies, and that definitely all of them have limited available time to devote to use complex decision support tools (Loizidou and Loizides, 2012b). Consequently, decision makers find them difficult to use and often prefer to rely on their intuition, judgment and sometimes even interests. Nonetheless, that is not to say that decision-makers would oppose having a tool that would help them make informed and documented decisions. In fact, research finds that decision-makers, who generally prefer to maintain autonomy and accuracy in their decision-making, would like to receive information about the available alternatives on which to base their decisions (Dalal and Bonaccio, 2010). This suggests that there is room for a decision support system that is quick and easy to use, would give the decision makers the factual information they need and would be flexible to accommodate a wide range of policy decisions and academic backgrounds.

These challenges led the authors to develop the 'DeCyDe' decision support method, with the aim of providing decision makers with a simple and easy-to-use method and tool, which can give a numerical value to a problem or issue that has been considered, up to now, subjective or difficult to quantify (Loizidou and Loizides, 2012b).

2.0 What is DeCyDe-4 method

DeCyDe-4 is a recently developed decision support method. It is a site and case specific method, i.e. the decision support model is structured for each site/ area of implementation and for each case of implementation. It serves a triple target of decision needs:

- strategic decision support method
- experts and key actors involvement and engagement tool and
- a self- assessment tool

The DeCyDe-4 method is a policy oriented decision support method and tool. Its step-wise, cyclical procedure takes the user from the starting point to the expected end point in a logical manner. It is a simple, user-friendly and flexible method, able to accommodate different kinds of decision problems when multiple decision alternatives exist. It integrates logical processes and established scientific knowledge and local data, together with local knowledge and experience, in a highly participatory way (Loizidou and Loizides 2012b). Gamification characteristics have been introduced in the method, in order to achieve higher and more active decision maker engagement.

In summary, DeCyDe-4 is a spreadsheet-based decision support method, with a strong gamification character, that incorporates principles from multi-criteria analysis, public policy approaches and even basic logic principles from Fuzzy theory (the theory of graded concepts, where everything is a matter of degree).

It is structured in four, self-contained and yet interrelated steps. Each step can be used per se, giving specific results, useful for decision structure and support. At the same time, one step is feeding into the following one in order to lead to the final stage, where the actual decision support work is done.

Step1: The Data Base

Usually a major problem in decision making is the lack of consistent data or the low quality of existing data. The Data Base of DeCyDe-4 is built specifically and dedicatedly for every case that the method is implemented, taking into account the aforementioned data problems. This step actually forms the baseline work, the product of the identification of the problem and the gap analysis of the needs and the parameters that are involved in the specific decision process. The Data Base provides the set of “core” data that are needed in order to guarantee the unbiased character of the results of the decision process. It is very usual that the decision makers believe that their perception is the reality. This set of core data is organized in a way that supports the decision makers to picture the real image of the existing situation and understand the problem through numbers.

Step 2: The setting of criteria/ parameters

This is the part of the method where each case under examination is structured and modeled. Step 2 of DeCyDe-4 consists of two parts:

Part 1: Addressing the multiple dimensions and/or perspectives of each case. It is important to define the key set of criteria/parameters that are involved in the decision making process. This is achieved through a participatory process, where

the experts/consultants suggest a rather large set of parameters/criteria which is the result of their on-the-spot and issue-specific research. The decision makers and key actors/stakeholders are asked to go through them either during dedicated structured meetings/workshops or through e-communication, and through discussion to decide on the “core” set that is going to be implemented in order to support their decision. This is a highly participatory process that incorporates a simple step-wise approach: the availability of data, the definition and structure of the problem, the involvement of decision makers and key actors from the very beginning of the process, the recording of their perception and the achievement of their consensus on this initial part of the process: the structuring of the model through the set of criteria/parameters. In order for the process of this step to be effective, it is important to have a robust baseline study, a good set of data (the result of step 1) and a trained facilitator/expert who is not imposing decisions, but supports the process and has a good knowledge of the examined case, of the data and of local/case specific characteristics. It has to be clear and provide the decision makers/key actors/stakeholders with the reasoning that the aim is to solve the problem, to get a concrete result to support the decision to be made, than to attempt to model a system mathematically through a complicated process.

Part 2: The “scoring through ranges” of the criteria/parameters. This is one of the innovations introduced by DeCyDe and DeCyDe-4. The scoring of each criterion/parameter is achieved through given ranges of values. The “scoring through ranges” approach converts state-of-*<issue>* indicators, into dynamically evolving indicators. This is because the score attributed immediately gives a reference value and relevance instead of just a snap-shot single figure which stands for nothing but itself.

This step of DeCyDe-4 is the one that introduces in the system the local (national), European or international strategic goals: the ranges of values are mainly defined, based on European Union Directives. When these do not cover the specific parameters, limits provided by International Bodies are used. Local/National regulations are also considered. The approach to score through ranges instead of using precise values provides the method with flexibility: even data which cannot be specifically identified and have a level of being imprecise or give an approximation can be used if identified within a range. Thus, all key parameters/criteria can be incorporated in the decision process. Lack of a precise value is not a reason of exclusion for an important criterion/parameter for DeCyDe-4. This is an innovation which provides the method with high flexibility and integration ability.

Step 3: The Weighting

The criteria are organized in matrices, based on Saaty’s concept of comparing couples (Saaty and Sodenkamp, 2008). The number of matrices, i.e. the number of levels that will be incorporated in the decision support method is defined in step 2, when the key parameters/criteria are decided. Well structured workshops are organized, with the participation of the decision makers and the stakeholders that have already participated in step 2. It is important to structure a quick process. Time is a basic problem for decision makers, and quick and efficient processes are needed to achieve their involvement. The matrices are presented in a spreadsheet form. The weight/importance between a couple of parameters/criteria is agreed among the participants. By increasing the level of actual participation, and by enhancing conversation among conflicting interests, DeCyDe-4 achieves consensus building among the group of decision actors (decision makers, key actors and stakeholders) that are involved in the process. They get into a discussion that eventually leads them to a common perception

or at least common understanding on the most conflicting part of a decision making process: the level of importance/hierarchy of each criterion/parameter.

Step 4: Final stage

When all three steps are completed, the DeCyDe-4-<name_of_problem> spreadsheet tool is ready to be operated further: the decision makers can predict how the existing situation can be changed if, for example, they want to change the score of one or more parameters/criteria. That means that they can easily predict how the system will respond should they invest resources to support the change of score and thus the range, of a given indicator e.g. increasing resources in waste management recycling, by moving them from aquaculture production. Alternatively, they can forecast what will happen if they change the importance among the main pillars that form the specific problem e.g. what will happen if they decide to boost the “social” pillar of their development policy by increasing the funds allocated to improve the criteria/parameters of social pillar, by moving them from e.g. the Environment pillar. This decision demands a change in their policy, and this becomes clear to the decision makers when implementing DeCyDe-4. Through this exercise, the decision makers can evaluate and assess a large range of ideas and actions within different policy options. They have a “number” that gives them their “score” each time they would take a decision, based on real data of the existing situation. They have the chance to check the impacts of their decisions, identify the pros and cons of different options and discuss them among the entire group of decision actors and eventually reach an optimized decision. Because this decision is taken through a participatory process, with the consensus of the decision actors, there is a greater likelihood that they will all commit to support the implementation of their decision. This is one important issue: promoting the implementation of decisions through the consensus of decision actors (Loizidou and Loizides, 2012b).

3.0 Case Study: DeCyDe-4-sustainability

DeCyDe was modified/ customised to accommodate the needs of the Interreg IVC project SUSTAIN. One of the aims of SUSTAIN was to provide Local Coastal Authorities and Local Coastal Decision Makers with a tool that could help them assess whether their decisions, policies and actions would lead to a sustainable future. In other words, the question was how to “measure” sustainability and how to “track” the changes, improvements or not, and quantify them, i.e. give them a “number” which could be comparable in time.

The SUSTAIN group modeled coastal zone systems through 42 parameters/indicators, the SUSTAIN sustainability indicators (SUSTAIN Partnership, 2012a). The authors transferred the SUSTAIN set of indicators into the DeCyDe-4-Sustainability tool and (a) drafted a list of data and their format/units, that should be provided from each SUSTAIN partner in order to implement DeCyDe method and run DeCyDe-4-Sustainability in each partner’s area; (b) gave ranges to each indicator in order to proceed with the scoring, according to the process already described above (step 2, part 2); and (c) set up the decision support spreadsheet, the score-sheet with the weighting matrices. In short, the DeCyDe method was implemented from start to finish, going through Steps 1 to 4 (SUSTAIN Partnership, 2012b).

DeCyDe-4-Sustainability was presented to the SUSTAIN partners in 3 dedicated workshops (Newcastle Co. Down (UK), Cork (Ireland), Lisbon (Portugal)). The partners implemented and validated it, each in their country. Figure 2 presents the final self assessment score sheet of DeCyDe-4-Sustainability. Thus, DeCyDe-4-Sustainability was implemented by the 12 country-partners of the SUSTAIN project and the details of the implementation as well as the scores for each areas sustainability performance are included in the report of the SUSTAIN Partnership (2012b). The overall validation of the method was positive and it is recorded in the conclusions of the above mentioned SUSTAIN report/Guide: *“Through a participative approach, a mix of eleven local and regional authorities, research institutes together with an NGO and independent consultancy bureaus have selected and tested a methodological approach, an innovative set of indicators and a scoring methodology which allows the movement towards or away from sustainability to be measured.*

Data collected for the indicators can be fed into the DeCyDe tool which will produce a score and allow an authority to compare, in the future, whether it is moving towards its strategic policy goals set for achieving sustainability. It also allows predictions to be made to determine how different policy options will affect this progress towards a more sustainable future. The Methodological Approach, SUSTAIN Indicator Set and DeCyDe tool together constitute a friendly-to-use rapid implementation, self-assessment tool. The tool respects the time limitations of policy-makers and other stakeholders. It is also highly sensitive and robust in assessing different options and impacts of decisions while allowing for flexibility and adaptive management”.

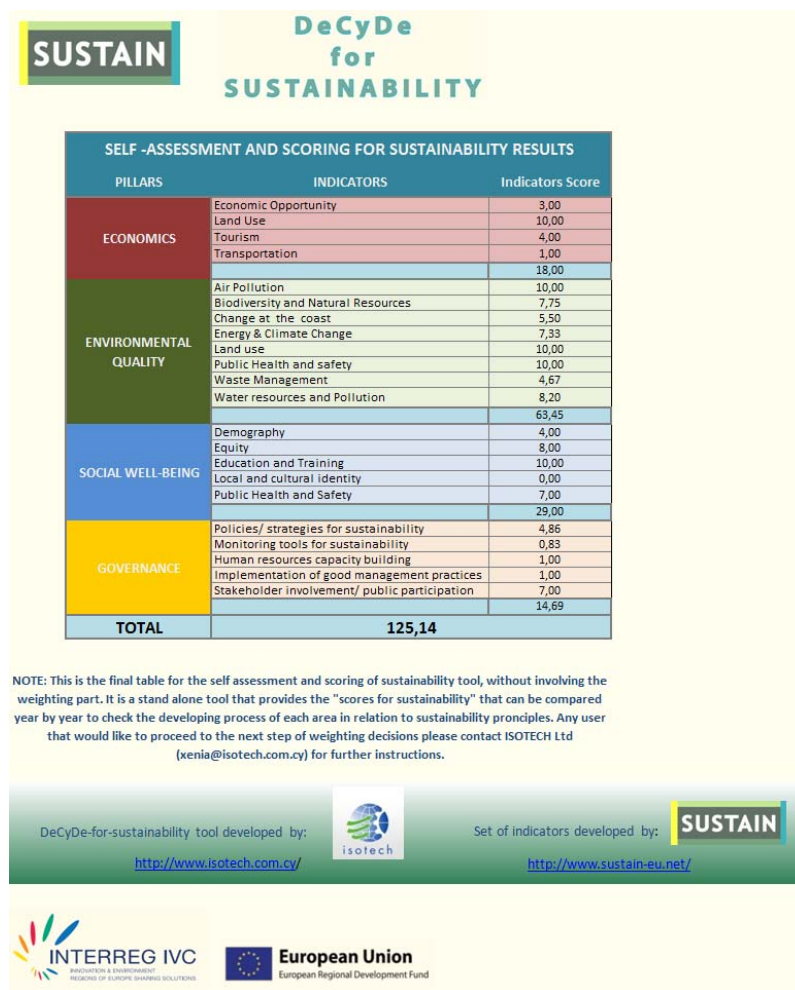


Figure 2.1: the Self Assessment Tool of SUSTAIN

4.0 Conclusions

DeCyDe-4 is a transparent and effective method that aims to facilitate decision makers and decision actors to participate in a well structured decision support process. The DeCyDe-4 decision support method has high sensitivity and robustness, is simple to use, flexible and adaptable. It is also “fun” for the participants (incorporates gamification characteristics) and fast, saving decision actors time. It is a multi-task/multi-purpose/multi-use decision support method.

DeCyDe-4 is characterized by five key attributes:

1. DeCyDe-4 removes the bias from the scientific part of decision-making, since the database of information that is used in the scoring process as well as the ranges and scores for each criterion/parameter are derived from European and National legislation and standards by local experts and scientists. Through this process, the scoring by stakeholders and decision-makers becomes a matter of reading, rather than interpreting, the scientific evidence.
2. The method introduces innovative approaches in the decision support process, through the transferring of the characteristic parameters of the problem under consideration, into decision support criteria

3. Decision is based on facts and data rather than on perception and intuition.
4. It is a truly participatory method, since stakeholder participation is not only encouraged but actually required in two key steps of the methodology: the definition of the criteria/parameters to be assessed and the determination of the weights that are assigned to each criterion/parameter. This was a key consideration by the DeCyDe developers, since it has been quoted many times that participation increases the knowledge of the group and ensures that all views are being heard, increases the acceptance and ownership of the results, ensures that the decision-making process is dynamic and promotes the democratic character of the process (Kørnøv and Thissen, 2000).
5. The method results in a final numerical value which allows the decision-makers to make comparisons against time as well as test possible options (in term of their overall score). This offers a framework that supports the decision makers and the stakeholders to understand and justify the main issues that are involved in the process of decision-making and the trade-offs between different decisions alternatives.

Coastal adaptation to climate changes is urgent. Integrated Coastal Zone Management provides with an efficient decision framework. Easy to use, participatory and robust decision support methods and tools are a step towards the effective adaptation process.

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