A methodology for policy analysis in water resources management

Authors:

Jacobo Feás Vázquez

Fondazione Eni Enrico Mattei

Italy

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J. Feás Vázquez*

FEEM Fondazione Eni Enrico Mattei. C. Santa Maria Formosa, 5252. 30122 - Venice - Italy

Abstract

This paper illustrates the adoption of the DPSIR conceptual framework in the structuring phase in a Multicriteria Analysis (MCA) concerning the evaluation of water policies. In this paper we propose part of a methodology to facilitate the decision making process in water resources management under the perspective of the WFD, that has been developed in the MULINO project.

Keywords: Water Policy, DPSIR, Multicriteria Analysis, Water Resources Management.

Introduction

At the end of 2000, the European Commission published the Directive 2000/60/CE establishing a framework for Community action in the field of water policy that may be considered as the “most significant piece of European water legislation for over twenty years” (Foster et al., 2000). This new legislation through 26 articles provides for achieving the sustainable management of water resources under an integrated approach.

The new challenges posed to the people responsible for the management of water resources across the European Union include the coordination of existing national policies with the stipulations of the WFD. It has been designed to resolve some of the more persistent problems that obstruct the achievement of the EU environmental objectives, and can be interpreted as an attempt at

* Corresponding author. Tel.: +39 041 2711 405; fax: +39 041 2711 461
E-mail address: jacobo.feas@feem.it

establishing a coherent legislative framework for the protection and improvement of the water environment within the context of achieving sustainable development.

Under the WFD, we try to highlight in this paper the difficulties that policy–makers find when they have to deal with decision related to the environmental field and in particular with water management. We propose the use of multiple criteria decision aid methods based on an environmental assessment tool called DPSIR framework as a methodology to facilitate the public environmental planning and decision process in a context of sustainable and integrated water resources planning and management.

The complexity of Integrated Water Resources Planning and Management

Integrated Water Resources Planning and Management is considered a very complex issue since it is usually solved by the multisectoral-interdisciplinary hierarchical decomposition approaches. In general, integrated management indicates the consideration of water, social, socio-economic, economic and environmental issues.

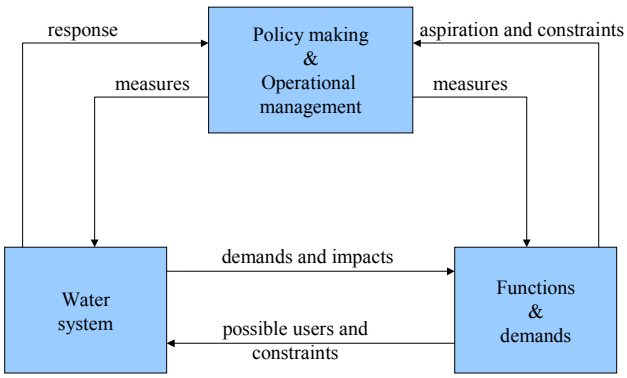

Figure 1: concept of integrated water resources management
(Bogardi, 1994)

But it's also necessary consider, like in environmental planning in general that to complicate the process further, there are a large numbers of decision-makers

involved in the process with conflicting preferences and value judgements (Lahdelma et al. 2000).

Decision problems concerning environmental and natural resources management are usually complex or even hyper-complex problems (Brans, 2002) A deep analysis and decision making process require a high background in environmental, economic and social disciplines The paradox here is that the scientific community is mostly working on very detailed and more narrow aspects whereas the managers require a holistic and ecosystemic approach, not necessarily at a high level of detail (Elliot, 2002). But the gap between those who analyse and those who decide, is not only in the knowledge but also in the aims and the way of thinking (Luiten 1999). For that reason, our objective proposing the present methodology is to link politic and science world providing a tool to facilitate the communication between them.

But the complexity goes further if we consider the administrative aspects of the environmental decisions. Any decision related with water resources management in Europe is undertaken within the framework of policy. But this policy framework could be established at various hierarchical administrative levels, starting from local authorities, regional and national governments, to European Union and another international levels.

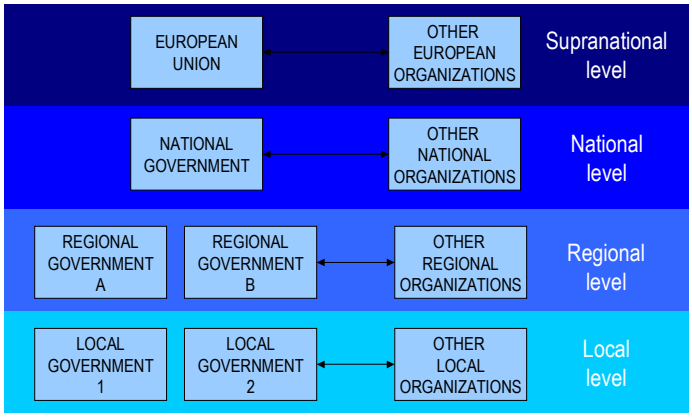

Figure 2: Structure of policy units

At this point, sometimes is not easy to develop policies with the agreement of all the policy units involved in the water resources management. When we are

dealing with different levels of policies some conflicts may arise because the differences in objectives and goals pursued by the policy units. Decisions at national level could not satisfy the values and perceptions of the policy units at local level.

The last point to remark in this complex framework is the existing links between water policy and other related fields because decisions in water resources management affect, and are affected by other policy areas. So we cannot consider water policy as an isolated task, neither the development of policies in other areas without references to the water policy. Areas like environment, energy, industry, agriculture, tourism had an important role in the water resources management and water policy.

The purpose of the methodology proposed is to support the assessment of policy analysis in order to measure how a specific policy meets the objectives established by the policy units/actors. Also allows to identify the possible conflicts that may arise between and within different policy units helping to clarify the reasons of the discordances between them. Analysing these reasons we can set up the basis for a better understanding or possible paths to arrive at a compromise resolution of the conflicts.

The basis of this methodology is the Multicriteria Decision Analysis which principal objective is “help decision makers learn about the problem situation about their own and others values and judgements, and through organisation, synthesis and appropiate presentation of information to guide them in identifying, often through extensive discussion, a preferred course of action” (Belton et al, 2002).

Using Multicriteria methods in water resources management

Using Multicriteria methods we don’t try to obtain the right answer when we have to decide between different sets of policy options, neither provide an objective analysis will relieve decision makers the responsibility of making

difficult judgements. We try to make the subjective judgements explicit and the process by which they are taken into account transparent, which is very important when a large number of actors are involved in the decision process (Belton et al., 2002).

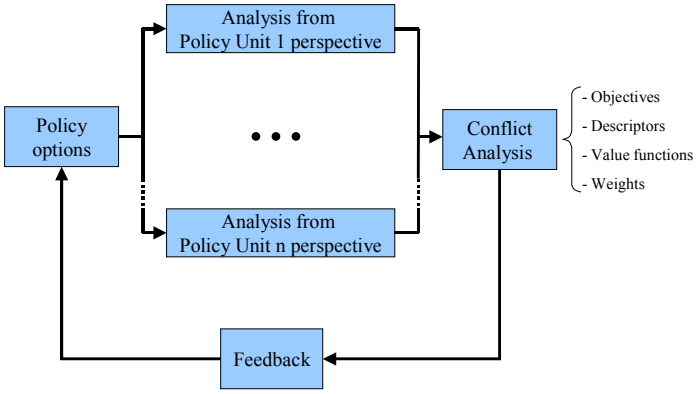

Figure 3: Conflicts between policy units

So the main idea is to show how to explore and evaluate the objectives, judgement values, constraints and impacts of a policy from a single actor/policy unit perspective and how to compare different options. This is based on a multicriteria model, which associates to each policy option an index of attractiveness, which depends on the impacts of the policy and on the subjective values of those who evaluate it. This index can be used to compare options with each other (policy unit/actor) or to assess the absolute attractiveness of a policy option.

There are a lot of MCDA approaches but in general terms, the MCDA methodology unfolds in a series of stages:

- Problem structuring, that is the analysis of the concerns of a unit and the selection of the descriptors to specify the impacts of policy options;
- Model building, which is the construction of the value index, which serves to state the attractiveness of a policy option for a policy unit.

- Elaboration of recommendation that is the substantive interpretation of the evaluation in terms of guiding the behaviour of the policy unit in the decision process.

The DPSIR framework to structuring the decision problem

The formulation of a problem is often more essential than its solution, which may be merely a matter of mathematical or experimental skill (Einstein, 1938).

The process of structuring a decision making process seems to be the most valuable and the essential part of the MCDA methodology. Moreover, all the MCDA methods are based in how the decision makers expresses the main concerns about a problem, so if the problem is not well defined, their preferences will not be constructed a robust way.

Most of the MCDA applications on water resources management start their analysis adopting a stance of "given the problem" and are more focused on evaluation stage and the elaboration of recommendations.

In the last decades, a large set of evaluation techniques had been developed, but in our opinion the most difficult and important matter in this context is to identify the fundamental concerns of the decision process: goals, constraints, uncertainties, actors involved, alternatives…In this paper we are mainly focused on the structuring stage of the decision process on the idea that more time and effort should be spent on the phase of structuring a decision making problem, as this step might have consequences throughout the rest of the decision process[1].

Following the methodology proposed by Bana e Costa and Beinat in the DTCS project, we can define concern as any aspect within a specific context that

[1] The hole methodology is been developed under the MULINO project through the production of a decision support system called Mulino DSS (mDSS).

policy actors consider relevant for evaluating the attractiveness of policy actions. This definition includes both objectives of policy units/actors involved in the decision process, and the characteristics (or attributes) of policy actions. These concerns may differ between the different policy units involved or even between different actors within the same policy unit

But the task to identify these main concerns (both stated objectives and active characteristics) for each policy is not easy under this complex framework. The identification of this set of indicators is a prerequisite to represent the main concerns assessing and reporting the state of the environment and its evolution as affected by human activity But also is necessary a definition of a functional scheme to describe cause-effect linking the state of the various –ecological, economic, social, technological– indicators..

The OECD has argued that a successful indicator should:

- Reduce the number of measures which normally would be required for an exact presentation of a situation; and
- Simplify the process of communication to managers, stakeholders and communities.

In short, indicators should represent dynamic parts of an overall portrait that is understandable and compelling to its intended user community. They should be part of a process to minimize the number of individual variables and data points while maintaining a sufficient level of critical understanding to those responsible for or interested in coastal systems (Bowen et al, 2003).

But a simple set of indicators not satisfy the holistic perspective that's needed when the decision makers need to represent their point of view, because of their probably poor background of this technical aspects.

Relevant examples available to explore these issues and to support the structuring phase in this field are the PSR scheme (Pressure - State - Response), adopted by the Organisation for Economic Co-operation and Development (OECD, 1994), and the DSR (Driving force - State - Response) of

the UN Commission on Sustainable Development (UN, 1997). More recently the DPSIR framework (Driving Force - Pressure - State - Impact - State - Response), was proposed by the European Environmental Agency (EEA, 1999) and adopted by many national and European institutions, EEA and Eurostat among other

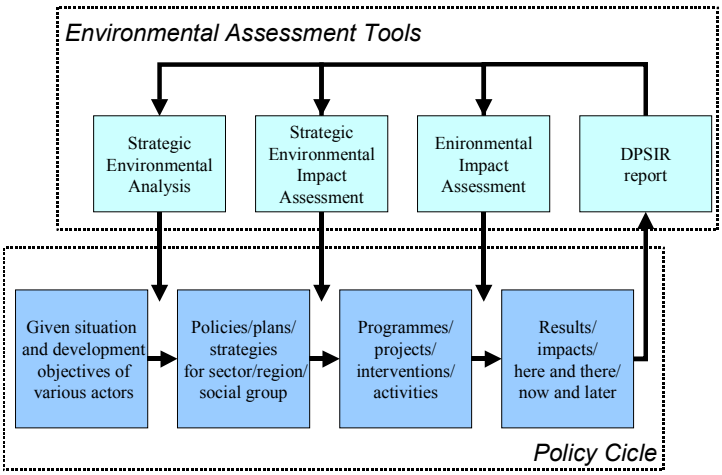

Figure 4:Policy cycle and environmental assessment tools

The DPSIR framework was originally developed by the EEA for environmental reporting purposes, as result of environmental monitoring, on different environmental assessment tools like Environmental Impact Assessment (figure 4), and structures the description of the environmental problems, by formalising the relationships between various sectors of human activity and the environment as causal chains of links.

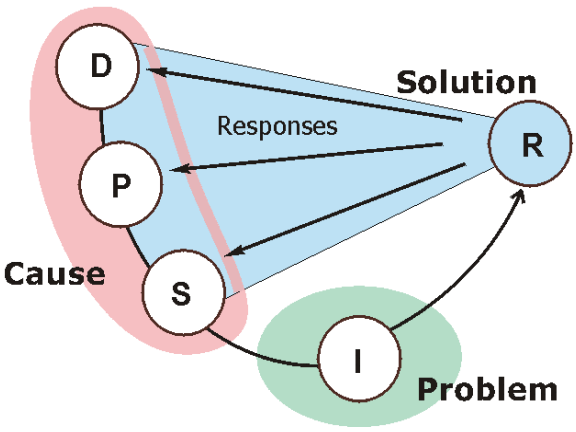

Figure 5: Decision Making withing the DPSIR framework

The environmental management process under the DPSIR framework, may thus be described as a feedback loop controlling a cycle consisting of five stages (figure 5).

- ***Driving forces*** are the underlying causes, which lead to environmental pressures. Examples are the human demands for agricultural land, energy, industry, transport and housing.
- These driving forces lead to ***Pressures*** on the environment, for example the exploitation of resources (land, water, minerals, fuels, etc.) and the emission of pollution.
- The pressures in turn affect the ***State*** of the environment. This refers to the quality of the various environmental media (air, soil, water, etc.) and their consequent ability to support the demands placed on them (for example, supporting human and non-human life, supplying resources, etc.).
- Changes in the state may have an ***Impact*** on human health, ecosystems, biodiversity, amenity value, financial value, etc. Impact may be expressed in terms of the level of environmental harm.
- The ***Responses*** demonstrate the efforts by society (e.g. politicians, decision makers) to solve the problems identified by the assessed impacts, e.g. policy measures, and planning actions.

DPSIR and decision making

Within this framework the task of decision makers (DMs) is therefore that of analysing the territorial system and assessing the acting Driving forces, their Pressures, the consequences on State variables and their ultimate Impact. From the assessment of Impacts they should determine appropriate Responses, in order to direct the final effect in the desired direction (a reduction in environmental harm). Therefore in a decisional context related to natural resource management, Impacts describe the existing problems arising from the

change detected in State variables, which reduces the value (either in quantitative, economic, or qualitative terms) of the natural resource.

The level of the responses has to be related to the magnitude of the impacts. These different responses need different planning process and different DMs could be involved. The different planning levels could be policies, plans, programs (PPP) and projects, from macro to micro level and the DMs could be from European to local authorities.

In our particular analysis, we are focused at catchment's scale and for that reason, DMs are not able to propose responses at driving forces level with macro/sector policies. Main of their responses should be included in environmental policies (i.e. regional environmental policies) at pressure level or with some specific projects at state level. In any case, whatever the response, DMs have to be coherent in the environmental planning process with policies, plans and programs established at a higher level (i.e. irrigation project coherent with regional environmental legislation, this one coherent with national legislation under the WFD perspective)

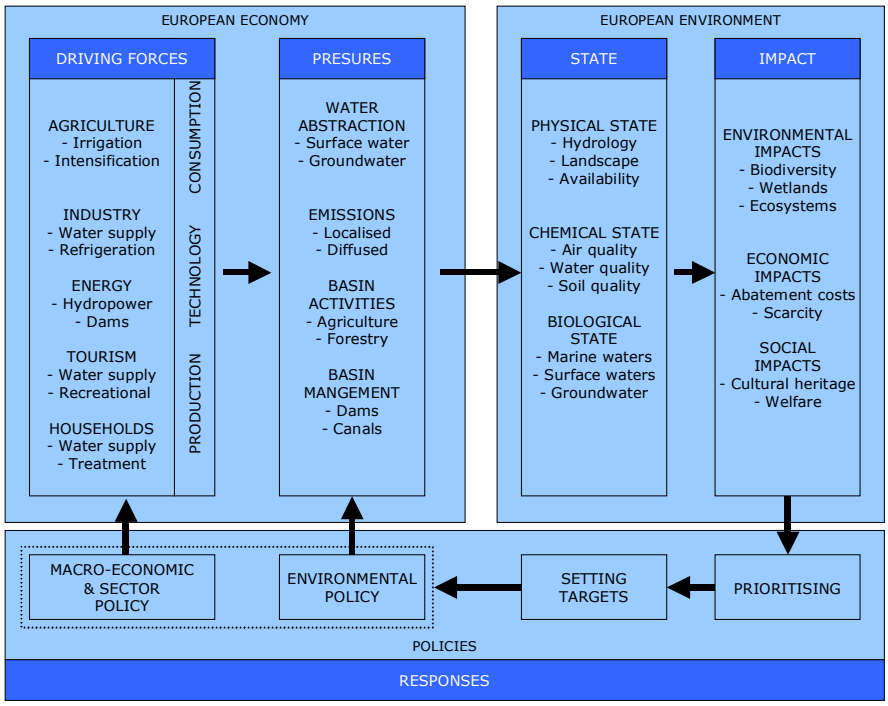

Figure : Integrated Environmental Assessment DPSIR framework applied to water management (adapted from NERI 1997)

DMs, who could potentially take advantage of the DPSIR approach, range from high level (national and international) policy makers to local managers and administrators. Driving forces, Pressures and States are the possible levels of intervention, as depicted in figure 2: depending on his/her responsibilities and capabilities, the DM could be able to act at different level. In general, local managers may not be able to intervene on the main socio-economic Driving forces, but within their specific jurisdictions may effectively deal with the State of the environment, or with some of the Pressures. Conversely, the higher level policy making bodies act on Driving forces and Pressures, having instead fewer possibilities to deal directly with environmental conditions or State. In any case a coordination effort should be required in order to produce am efficient response.

Conclusions

From the above, the potentials of the DPSIR approach for decision making process and policy analysis in the field of natural resource management should result clear. Nevertheless the methodology for an effective implementation of a decisional process in the DPSIR framework is far from being clear, nor unique, as demonstrated by the substantial lack of implementations outside the field of environmental reporting. The adoption of the DPSIR scheme has been developed in a operational DSS tool by the MULINO Project (mDSS) within the development of innovative theory and methodologies aimed at transforming a static reporting scheme in a framework for dynamic integrated assessment modelling (IAM) and evaluation procedures.

Acknowledgements

This work was funded, in part, by the European Community Marie Curie Fellowship, and through the MULINO project.

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