

# DECISION-MAKING FRAMEWORKS FOR CONTROVERSIAL PUBLIC DECISION PROCESSES: A COMPARATIVE ANALYSIS WITH A CASE STUDY

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**Abstract**

Earlier approaches and most current practices of project evaluation are still driven mainly by technical and economic concerns and do not incorporate environmental or social issues. Therefore, they have failed to account for sustainability concerns in the evaluation of major projects with environmental impacts. In this paper we develop a comparative analysis of three new decision-making frameworks for the assessment of the sustainability of these projects. We analyse similitudes and differences, regarding their theoretical base, objectives, overarching issues and operational implementation, aiming to reveal the main issues of the evaluation process. We also present a case study, with the critical analysis of the ex-post evaluation process of the Alqueva dam multipurpose project based on the comparative analysis of the methodological frameworks presented. The aim is to illustrate the relevance of these methodologies for the improvement of the evaluation processes vis à vis more traditional practices.

**Key words:** Decision-making process, strategy, sustainability, Alqueva project

**JEL classification:** L38; O22



## 1. INTRODUCTION

Many major projects require rather lengthy and controversial decision making processes. Different development options and strategic issues, multiple interests, environmental issues and uncertainties are typical features of the decision processes of those projects.

Earlier approaches and most current practices are still driven mainly by technical and economic concerns and do not incorporate environmental or social issues. The evaluation process continues to be closed to multiple interests, and certain alternatives and criteria for assessment result excluded. Conflicts of value, often linked with the uncertainty related to possible negative environmental impacts, are a relevant consequence. Therefore, evaluations have failed to account for sustainability concerns.

This has to be changed in order to enable sound and sustainable decisions. New instruments have been recently identified by researchers to better guide on how to perform project evaluation and move towards sustainability-oriented objectives.

In this paper we develop a comparative analysis of three new decision-making frameworks for sustainable projects. We analyse similitudes and differences, regarding their theoretical base, objectives, overarching issues and operational methodologies, aiming to reveal the main issues of the evaluation process.

We also present a case study, with the critical analysis of the evaluation process of the Alqueva multipurpose project based on the comparative analysis of the methodological frameworks presented. The aim is to illustrate the relevance of these frameworks for the improvement of the assessment processes vis à vis more traditional practices.

The paper is structured as follows. Section 2 refers the main elements of the decision making process, including main decision approaches and devices. Section 3 describes the decision-making frameworks selected for the comparative analysis. Section 4 presents the case study that illustrates the applicability and the relevance of those frameworks for major project evaluation. Finally, Section 5 concludes.

## 2. ELEMENTS OF THE DECISION-MAKING PROCESS

Theoretical contributions to decision making have come from different academic discipline. We consider here theories around organizational behavior, founded through work by Weber (1947) and developed by Simon (1960, 1976) and Mintzberg (1976) with management science and the theory of planning.

Research has yielded different analytical frameworks for enabling management to achieve the set objectives, and two main approaches may be singled out: models that consider decision making as technocentric, sequential or “rational” and models that describe decision making as deliberative and “incremental”.

According to the technocentric paradigm, decision-making should clarify objectives and set priorities, list all decision alternatives, evaluate their consequences and choose the alternative that optimizes the objectives. Decision, which is based on expert opinion and economic modeling, is very demanding on information, time and resources, especially in unstable environments with many stakeholders and insufficient information.

According to the deliberative paradigm, decision-making should be a systematic process of experimentation, learning and continuous improvement of policies and management practices and should lead to a satisfactory decision. Decision process responds better to concerns for transparency and pluralism in the formulation of policies but it makes planning difficult. Adaptive Management processes also fit in this paradigm (Williams, 2011).

The most applied devices of decision (in economics, management and environmental studies) are cost-benefit analysis in the first and integrated and multi-criteria analysis in the second paradigm. However, a variety of sustainability assessment tools may be applied, such as indicators / indices, product - related and integrated assessment tools (Ness, B. et al, 2007).

Sustainability issues are heavily influenced by ideology and economic and political interests and also by the design of institutional arrangements (Kim, 2010; Davidson, 2011; Memon et al. 2011). Thus, a deliberative process seems better suited to systems characterized by multiple possible trends, and therefore to the analysis of environmental issues.

Management science considers that decision-making must be seen as a policy process of different stages and step linked together in a systematic way. These include searching for contextual conditions and problems requiring decision; the definition, development and analysis of possible courses of action; choosing a course of action among the possible options (Nilsson and Dalkmann, 2001).

### **3. THREE DECISION-MAKING FRAMEWORKS AND A COMPARATIVE ANALYSIS**

We consider the following three decision-making frameworks: the mega-projects framework of Priemus (2010), the proposed approach of Strategic Environmental Assessment (SEA) by Partidario (2009) and the river basin framework by Videira et al. (2007).

### 3.1. Objectives and applicability

All three frameworks arise to address the shortcomings of current decision practices in project evaluation.

Priemus (2010), referring to major transportation infrastructure projects and other mega-projects, notes that there are recurring problems of cost overruns and demand shortfalls and also that this is strongly due to institutional factors. With mega-projects framework he intends to contribute to deal with these and other problems in the decision-making process.

The SEA framework (Partidario, 2009) considers strategic decisions involving environmental issues at all levels of decision-making (policies, plans, programmes or projects). Partidário considers that the European Directive 2001/42/EC, commonly known as the SEA Directive, and current frameworks and practices of SEA<sup>1</sup> have not worked as an effective strategic-based instrument applied to complex decision making processes and argues that they should better adapt to the actual policy and planning processes. For this purpose, a strategic-based and sustainability-oriented SEA methodology was developed, including a set of functions that it must fulfill and a general format that it must assume.

The river basin framework is based on the undertaking of the ADVISOR research project<sup>2</sup> which aimed mainly at “improving the understanding of evaluation processes, as part of river basin planning and management” (Antunes et al, 2009, p.931). It is based on the diagnosis obtained from the analyses of five cases of European past river basin governance processes and then developed on the grounds of context, participation, information and assessment activities found in case analysis. Some common patterns emerged namely the bad quality of knowledge about relevant issues, incomplete and arbitrary assessments, conflict arising from exclusionary governance processes or late involvement of those concerned in the processes. The ADVISOR project also provided a structured procedure to achieve integrated evaluation for designing and implementing these processes.

Although they appeared linked to different areas of activity (infrastructures, strategic sectors, water resources) and decision levels (plans, programs and projects), the three frameworks apply equally to the analysis and evaluation of large investment projects with multidimensional impacts (environmental, economic, social,...), involving complexity, uncertainty and multiple interests, and therefore to the analysis of the

### 3.2. Principles and features

The basic idea of the mega-projects framework is that the decision-making process should be defined, in an integrated way, as a "knowledge-intensive learning process, in which many stakeholders and citizens are involved" (Priemus, 2010, p.1024). Options should be maintained to guarantee flexibility and adaptivity as long as possible in order to cope with uncertainties in markets, politics and technologies<sup>3</sup>. This would "improve the quality of the outcome and it strengthens the democratic dimensions of the decision-making process" (Priemus, 2010, p.1024).

In order to deal with project's issues and to "create structure and increase flexibility" (Priemus, 2010, p.1030), the decision-making process should be developed into a set of phases and steps.

Concerning SEA, Partidario (2009, pp. 4-5) looks at a framework that "proactively assists the shaping and the design of strategies" with a flexible process of strategies formation and assessment. SEA major key role is "facilitating decision-making by involving key actors, enabling dialogues towards mutual understanding, ensuring a long-term and large scale perspectives, when considering development options". SEA should also "aim to ensure the inter-linkages between the social, physical-ecological and economic systems" with integrated and sustainability assessments.

In order to form a more systematic SEA process a general format of a set of connected activities to enable a strategic performance is suggested.

Regarding the river basin framework, the underlying hypothesis is that the evaluation procedure of new plans and projects is critical for the outcome of river basin management and that it should evolve into "a new, multi-dimensional and multi-stakeholder participatory deliberative approach" (Videira et al., 2007 in Antunes et al, 2009, p.933). An integrated and context dependent evaluation procedure is required.

Guimarães-Pereira and Corral-Quintana (2009, p.940) consider that this approach may be developed as a quality assurance process, in an inclusionary fashion embedded in the social context where "evaluation procedures ensure that outcomes are technically and scientifically reliable, as well as socially robust". Four principles are proposed<sup>4</sup>: inclusive governance, transparent assessment, socially robust knowledge and extended peer review.

A set of guidelines including a structured process and the description of the general tasks and steps for the operational implementation of this approach, called "Integrated Deliberative Decision Processes" (IDDP's) was also provided (Videira et al., 2007).

Thus, all three frameworks present principles and features that are essentially similar and only differ by their focus of concern.



All of them consider decision-making as the result of a phased process involving integrated evaluation of multiple dimensions of analysis. All the models refer that careful attention should be given to the content of the decision process (in terms of quantity and quality of information and knowledge) and to stakeholder participation. They also consider the need of assuring flexibility and adaptability to deal with uncertainties and institutional changes so as to assure a better quality of the results to be obtained.

Regarding the focus of the concern, the mega-projects framework highlights the importance of ensuring a flexible approach to better deal with uncertainties of multiple nature throughout the decision-making process. The SEA framework has a strong concern with strategic issues, environmental priorities and long-term sustainability. The river basin framework highlights the need to consider integrated deliberative decision processes and to ensure the quality of the evaluation process.

### 3.3. Operational methodologies

In this section operational methodologies for the decision frameworks are presented.

#### Mega-projects framework

The problems which often occur in the decision-making on mega-projects, according to Priemus (2010) are listed in Table 1.

**Table 1 - Mega-projects problems**

List of problems	
<ul style="list-style-type: none"> <li>– Absence of an adequate problem analysis;</li> <li>– Lack of alternatives;</li> <li>– Absence of a functional programme;</li> <li>– Ambiguities about the scope of the project;</li> <li>– Flawed process architecture;</li> <li>– Questions regarding the Social Cost-Benefit Analysis;</li> <li>– Contested information;</li> </ul>	<ul style="list-style-type: none"> <li>– Problems with land acquisition;</li> <li>– Nature of the technology;</li> <li>– Changing markets;</li> <li>– Political discontinuity and inconsistencies;</li> <li>– Changing standards and changing legislation;</li> <li>– Prioritization of mega-projects</li> </ul>

Source: Priemus (2010)

To deal with them the decision-making process should be structured in four phases (Table 2).

**Table 2 - Mega-projects decision-making process**

Decision phases	Steps
1. Problem analysis	<ul style="list-style-type: none"> <li>– Do not start with a solution</li> <li>– Project alternatives</li> </ul>
2. Functional programme	<ul style="list-style-type: none"> <li>– Programme of requirements</li> <li>– Scope of the project</li> <li>– Process architecture</li> <li>– Social Cost-Benefit Analysis</li> <li>– Negotiated information</li> </ul>
3. Preparation and realization of the project	<ul style="list-style-type: none"> <li>– Land Acquisition</li> <li>– Choice of technology</li> <li>– Deal with changing markets</li> <li>– Deal with political discontinuity and inconsistencies</li> <li>– Deal with changing standards and legislation</li> </ul>
4. Operation of the project	

Source Priemus (2010)

“Problem analysis” deals with the existing problem and whom it affects. The decision-making process should begin with a broad and participated problem analysis and with the identification of a set of several potential different solutions for the problem or project alternatives.

A “functional programme” of requirements and criteria that the decision process has to meet should be prepared. These are a well-organized programme of conditions for tendering procedures (programme, minimum performance criteria, public values, etc.), the identification of the “right” scope of the project, which will allow to consider all available alternatives, and the establishment of a process architecture that defines the conditions for a consistent management of the knowledge and preferences of the stakeholders (public, local authorities, potential private players).

Ongoing improvement in social cost-benefit analysis should also be considered for the evaluation of economic, social and environmental effects. Finally, and to counter potential misinformation among different players (“contested information”, following Leijten and Bruijn (2008)), agreements should be reached in advance. Next phase, “preparation and realization of the project”, is the elaboration of the technical, operational and economic aspects and the preparation of the project until it is ready for execution.

Issues relative to land acquisition and to the choice of technology are often very relevant in infrastructural projects and should be properly weighted. To deal with uncertainties linked with

changing markets and their potential impacts on the analysis of costs and benefits, adequate techniques should be applied and options maintained to safeguard flexibility. To deal with political discontinuity, changing standards and legislation and with and lack of public consensus, relevant information should be consistently passed on to the public and to all players and the existing dilemmas discussed.

After the realization of the project, the operation may start. In this last phase combination of investment and maintenance activities and a life cycle analysis may be important to ascertain a sustainable solution.

### SEA framework

To enable a strategic performance the Strategic Environmental Assessment (SEA) process must be developed through a general format of a set of the following connected activities (Table 3).

**Table 3 - SEA strategic-based methodology**

<b>Methodological activities</b>
<ul style="list-style-type: none"> <li>– Establish a framework of institutional governance and participation, and recognise different perspectives.</li> <li>– Build a strategic reference framework (SRF) - working for a sustainable future and development objectives and creating an assessment benchmark.</li> <li>– Identify Critical Factors for Decision-Making (CFD) – priorities setting exercise, generating clusters based on the fundamental strategic issues (SI) for development, the relevant environmental factors (EF) and the macropolicy framework defined by the SRF.</li> <li>– Analyse trends, not moments. The strategic context is identified, based on an analysis of trends. What matters is a dynamic analysis, not a static analysis.</li> <li>– Conduct sectoral studies that perform an analysis of the CFD, and the assessment, to provide information to the decision-maker.</li> <li>– Analyse strategies and assess strategic options for different future scenarios.</li> <li>– Prioritise and explore plausible options that enable choice, foreseeing and avoiding risks and exploring opportunities.</li> <li>– Produce as many issues notes, comments and short reports as necessary, depending on the opportunities created by decision windows.</li> <li>– Propose guidelines that drive possible pathways, avoid the mitigation paradigm.</li> <li>– Strongly support the strategy life-cycle with a follow-up process that ensures: design, assessment, monitoring – integrating in the strategic process of decision-making.</li> </ul>

Source: Partidario (2009)

A methodological guidance for Strategic Environmental Assessment was also developed, with three decision phases (Partidario, 2007).

In the first one - design - the object of assessment (the underlying strategy) and the SEA objectives are identified. The Critical Factors for Decision-Making (CFD) that will provide the structure and focus of the strategic analysis and assessment must be selected. A framework of institutional governance and participation must also be established.

In the second phase - analysis and assessment - the technical studies are performed in accordance with the selected CFD and established level of detail and scope. Trends are analysed through scenarios development and options identification and assessment. Environmental and sustainability opportunities and risks must also be assessed. Finally, guidelines for the follow-up phase must also be prepared.

In the last phase – follow-up - the objective is to develop a follow-up programme (planning, monitoring, management and assessment) and the institutional adjustments required for good governance over the subsequent years.

We may link the methodological activities in Table 3 to these decision phases in the following way: the three first activities to the design phase, the next six activities to analysis and assessment and the last activity to the follow-up phase.

In a recent paper, Partidario and Coutinho (2011) present an example of the use of SEA methodology in the study of the location of the Lisbon new international airport, which highlights its relevance and applicability in mega-project decision-making.

Based on the experience with this case, they highlight the importance of using a strategic and sustainability approach, where all aspects of the multiple dimensions involved are brought together. In the study, the SEA application was highly focused on the critical factors identified by the decision-makers and other stakeholders involved<sup>5</sup>. This also contributed to outcomes that were clear and easy to communicate to politicians and to the general public. Finally, this case, which adopted an approach that had not been prescribed, showed the importance of "allowing flexibility" in the decision-making process.

### **River basin framework**

The ADVISOR project provided a set of guidelines including a structured step-by-step procedure (Table 4) to achieve integrated evaluation for designing and implementing river basin decision processes, called “Integrated Deliberative Decision Processes” (IDDP’s) (Table 4) (Videira et al., 2007). This procedure is characterized by participatory processes that promote open and constructive dialogues between the interested parties, as opposed to the traditional

mechanisms, mainly characterized by one-way information flows between the public and the decision-makers (Videira et al, 2006).

**Table 4 – General tasks for performing an IDPP**

Task	Description
1	– Set up organizational scheme
2	– Define goals
3a	– Choose and design tools
3b	– Decide representation and participation process
4	– Establish and implement an information quality assurance protocol
5	– Plan event(s) and resources
6	– Implement
7	– Evaluate process and results

Source: Videira et al., 2007

Clear rules should be defined beforehand, accounting for organization, representation issues and responsibilities for the planning and implementation of IDPPs. The sequence of activities and events (such as workshops or group meetings) to be developed, deliberation goals to be achieved and expected outcomes should be debated and decided at an early stage. Procedures and tools to fulfill the defined goals should be selected. A detailed workplan of the individual decision events should be prepared, including a budget of the activities to be carried out and participants to be involved. The process is then implemented and evaluated with its results.

Some different deliberative methods should be considered for the different tasks to try to account for multiple values, uncertainty in information and asymmetries between individuals, and to ensure that the outcomes are fit for use. Scenario workshops, for instance, for the identification of future options, participated modeling for problem definition, model conception and policy analysis for the evaluation of management alternatives (Antunes et al., 2009).

A structured and in-depth quality assurance process of evaluation with a set of attributes and criteria should be defined on a case-by-case basis. This set of attributes and criteria should cover the quality of information used and methodologies or tools deployed (Guimarães-Pereira and Corral-Quintana, 2009).

### 3.4. A comparative analysis

The table below (Table 5) considers the three typical broad phases of the decision process and relates to them the methodological stages of the decision frameworks presented above.

The comparative analysis of the decision-making frameworks shows that, despite their different perspectives, they are essentially very close together, not only in terms of their basic objectives and overarching issues but also in their operational methodologies.

**Table 5 - A comparative analysis of the frameworks**

Decision phases	Decision stages		
	Mega-Projects Framework	SEA Framework	River Basin Framework
Design	<u>Problem analysis</u> – Do not start with a solution – Project alternatives  <u>Functional programme</u> – Programme of Requirements – Scope – Process architecture – Social Cost - Benefit analysis – Negotiated information	– Framework of institutional governance and participation – Strategic reference framework; – Critical Factors for Decision-Making	– Set up organizational scheme – Define goals – Choose and design tools – Decide representation and participation process – Establish and implement an information quality assurance protocol
Preparation of the project	– Land Acquisition – Choice of technology – Deal with changing markets – Deal with political discontinuity – Deal with changing legislation	– Analyse trends – Sectoral studies – Strategic options assessment – Options risks and opportunities – Issues notes, comments and short reports – Guidelines (to drive possible pathways)	– Plan event(s) and resources
Implementation of the project and follow-up	– Realization of the project – Operation	– Follow-up process	– Implement – Evaluate process and results

Source: Priemus (2010), Partidario (2009) and Videira *et al.* (2007) (adapted)

The three frameworks have operational methodologies that share the same key stages, although under different forms. In the design phase, the establishment of a framework of institutional governance and participation, with requirements for information and assessment tools to be used and for the relationships with stakeholders, and in the preparation phase, the analysis and evaluation of alternative policy options.

Differences in the form of presentation of these stages have to do with specific focus of concern.

So, in the design phase, the mega-projects framework also considers the issue of the scope of the project, which is linked to the problem analysis and to the need to consider and study a broad range of project alternatives. The SEA framework considers the need of a strategic analysis and of using key decision factors. The river basin framework uses deliberative processes and considers also the implementation of an information quality assurance protocol.

In the preparation phase, the mega-projects framework addresses uncertainties of different nature (market, political, legal) and also some particular issues which are very relevant for transport infrastructure projects (land acquisition and choice of technology). The SEA framework considers the need for an adequate preparation of the assessment studies of alternative strategic choices with a long term vision and meets the need of communication and also of the preparation of the follow-up.

We may also see from this comparative analysis that, in major projects, it will often be necessary to reconcile “rational”-type analysis and deliberative and participative analysis in order to better integrate multiple interests and values, multidisciplinary and uncertainties. Therefore, decision-making should not be restricted to limited perspectives and methods, but instead use various techniques and methods.

#### **4. CASE STUDY**

In this section, the ex-post analysis of the evaluation process of the Alqueva Dam Multipurpose Project is presented, as a case study. The aim is to illustrate the relevance of the methodological frameworks presented for the improvement of the assessment of projects vis à vis more traditional practices. This analysis will also contribute to identify the limitations of the studies that were undertaken for the project.

This analysis was performed based on an extensive review of the official documentation concerning the public decision process adopted and other relevant sources about the project

(SEIA, 1995a, b, c; HP, Tractebel, SEIA, 1992, IPAMB, 1995; Videira et al., 2002; Platform for Sustainable Alentejo, 2005).

#### **4.1. Alqueva project brief description**

Alqueva is a multipurpose project that was conceived as a part of the Irrigation Plan of the Alentejo region in the south of Portugal, by means of setting up a strategic water reserve for water supply for irrigation (110 000 ha), population and industry (EDIA, 2012).

Initially conceived as a simple irrigation project to assist a predominantly agricultural depressed region and responding to perceived needs in the region for several decades, it included a substantial energy component after the 1970s oil crisis.

The evaluation and decision process of the Alqueva Project was very long and complex and of a great political and strategic relevance at national level, and was studied and debated during the last 40 years.

The first studies were carried out in the 1960s for the technical characterization of the project. Since the Guadiana river springs in Spain, it was necessary to establish a deal between Portugal and Spain about the use of water. This agreement was later renegotiated in 1998.

The Alqueva Dam is the main infrastructure of the project and is located on the river Guadiana. Alqueva is the largest artificial lake in Europe (250 km<sup>2</sup>) and has a total capacity over 4000 hm<sup>3</sup> and a full storage level at 152 m. The project also includes a hydroelectric plant, an adducting system for water supply and an irrigation system (EDIA, 2012).

The Alqueva project has very important negative environmental and social impacts. The submersion of a very large area implies the need to re-locate whole communities and includes some important ecological values and habitats in one of the most ecologically rich valley in Europe, and other impacts related to the quality of water for irrigation.

The dam's construction works began in 1995, co-financed by the European Union, after the approval of an "Integrated Environmental Impact Study of the Alqueva Project" and the creation of a public management entity, EDIA – Empresa de Desenvolvimento das Infraestruturas de Alqueva (Development and Infrastructure Company of Alqueva).

Finally, in the 8th of February of 2002, the doors of the Alqueva Dam were closed and the lake began to fulfill. In May 2004 the Hydroelectric Central was inaugurated. Although several environmental NGOs have defended a phased flooding of the reservoir area, in 2010 the lake reached the maximum water level.

At present, the completion phase of investments in the irrigation system is taking place. It is expected to last until 2013.



In addition to its importance for agriculture and energy, the project has been promoted heavily as a tourist facility and many planning applications have been submitted to local authorities by big corporations in and around the lake.

More recent studies have been concerned with the analysis of the development dynamics of the project, induced after its completion in agriculture, energy and tourism and in the consolidation of the business sector and employment in the region. The analysis of the management and maintenance strategy for the irrigation network and of its integration with energy and tourism are also being a focus of concern (EDIA, 2012).

#### **4.2. Critical analysis of the evaluation process**

The critical analysis of the evaluation process of Alqueva project is structured by the three phases and the main decision stages, common and specific, of the operational methodologies of the frameworks presented, with the following sequence:

<b>Decision phases</b>	<b>Decision stages</b>
Design	<ul style="list-style-type: none"><li>– Framework of institutional governance and participation</li><li>– Scope and problem analysis</li></ul>
Preparation of the project	<ul style="list-style-type: none"><li>– Options analysis and assessment</li><li>– Uncertainty analysis</li></ul>
Implementation of the project and follow-up	<ul style="list-style-type: none"><li>– Realization of the project, operation and follow-up</li></ul>

#### **Framework of institutional governance and participation**

The assessment of the Alqueva project had a very informal and iterative nature and did not follow a process of explicit and regulated steps, with criteria, procedures and generally accepted values. Main studies on the project were initiative of the government and conducted by consultants.

The project was approved after the elaboration of the "Global Assessment Study" (1992) but before the completion of the more comprehensive "Integrated Environmental Impact Study" (1995), and not giving rise to the evaluation of new alternatives. It seems to have been the European Union's intervention in the process of analysis and its co-financing of the project and not the results of scientific and technical analysis that precipitated the political decision of the Government.

Political forces and public opinion were involved mainly to discuss negative impacts and compensation measures in public hearings at a late stage and not in the development of scenarios and impacts. Some authors also state that the dam satisfies strong political and economic interests (in the construction industry, land owners, etc.) disregarding the real needs of development for the people allegedly benefitted (Veiga et al., 2008).

In the context of complex decisions and uncertain knowledge, such as in the case of the Alqueva project, and as recommended in the different decision-making frameworks, institutional agreements on the methodology and on evaluation procedures to be adopted should be established. The systematic implementation of devices for consultation and concertation of stakeholders and general public, and for collecting inputs, particularly in the development of scenarios and impacts, should also be considered. Information quality assurance protocols would also be important, as recommended in the river basin decision framework.

The establishment of deliberative type processes would be important, especially in a project like this one, which has a vast territorial impact and potential beneficiaries with sometimes divergent interests and values. These processes would allow to achieve consensus and to implement an effective participative governance that contributes to an integrated and sustainable development of the region.

### **Scope and problem analysis**

The evaluation process consisted of several studies that have expanded its scope over time. After an initial study which considered only the impacts of Alqueva dam and hydroelectric plant proposed in the surrounding area, the "Global Assessment Study" was larger in scope and considered the impacts of several different variants of the project alternatives defined depending on the storage level of the dam. But it had a very strong emphasis on economic and financial impacts, and less attention to important environmental impacts. The results of the study indicate generally positive impacts on regional development but without integrating properly the cost of environmental impacts. This led the government to approve the project on condition that the negative environmental impacts were considered and monitored.

The "Integrated Environmental Impact Study" was the most thorough in environmental analysis and fulfilled the new Portuguese legislation on Environmental Impact Assessment (EIA), in application of EU Directive. However, this study did not suggest any major project modifications. It basically assumed that the option was Alqueva at a full storage level of 152 m.

The great controversy was about the alternatives considered in the project. The costs and benefits of alternatives to the project, with other storage levels and other geographical options

and with integrated analysis with the environmental and social dimensions have not been studied. This issue is referred many times in the public statements from NGO's, that defended the construction of a network of smaller dams, considering real water needs in the short and long term and the possibility to downscale irrigation. This would minimize investment costs and economic losses and the ecological impacts of the project.

The important tourist occupancy for the Alqueva area (currently 30 approved projects), was also not studied, moreover involving risks not anticipated, as the construction of new access, occupation of farmland and waste water treatment, with a greater impact in sensitive areas and the countryside.

Alqueva had not, therefore, a prospective study, with the discussion of broad alternative strategic development visions for the region, as is recommended by the mega-projects and SEA frameworks. The basic nature of policy decision and the availability of funding from the European Union seems to have acted as an obstacle against a multidimensional assessment and forecasting.

### **Options analysis and assessment**

The "Global Assessment Study", evaluated several technically feasible alternatives with different irrigation areas and hydroelectric variants. The alternative selected was the construction of the Alqueva dam at a full storage level of 152 meters, aimed at the irrigation of 110 thousand hectares. It was assumed that benefits outweighed costs, but in a context of a very high uncertainty in many variables, which is common in water resources planning, and also assuming the availability of financing for the high investment and operating costs of the project. Thus, the strategic water reserve and regional development of Alentejo was not clearly demonstrated.

The "Integrated Study" started when the governmental decision to implement the Alqueva project was already taken and did not suggest any major project modifications. The emphasis was put on the implementation of compensation and mitigation measures to minimise the environmental impacts. The project results were considered dependable of the implementation and management of the project in the context of great uncertainty concerning several environmental impacts such as the quality of water and of soils and also of important lack of knowledge.

The preparation of the assessment studies of strategic development options, as recommended by the different frameworks, was also conditioned by the limited scope of Alqueva problem analysis.

In the studies of Alqueva, the methods of technical and economic assessment of impacts, especially the Cost Analysis Benefit and environmental impact assessments, were conducted, as generally happens in such studies. Some formal methods for comparing the various alternatives considered were also applied (such as multicriteria analysis in the "Global Assessment Study"). However, the evaluation does not reflect an "integrated perspective", dealing with uncertainty, plurality of environmental values, economic and social impacts and territorial cohesion, as is recommended by the different frameworks.

Information collected was based largely on the current situation and the impacts observed more than on the conditioning factors (causes), pressures and responses and the definition of strategic solutions adopted. Some additional and more recent data were also collected, but the fieldwork was done in a short period and most of the data collected do not have a significant temporal component.

The quality of the information was not accounted for in the process, as is recommended by the river basin framework. A greater effort to evaluate economic, social and environmental issues and more background information is required.

The formal participation process in Alqueva consisted of some public hearings mainly promoted through the "Integrated Study" with barely no impact on the development options of the project. The most discussed issues were the irrigation plan, aspects related with the scope of the project and its relevance, impacts on fauna, water quality impacts, determination of the ecological flows and socio-economic impacts (IPAMB, 1995). However, participation contributed to the implementation of mitigation and monitoring programs.

### **Uncertainty analysis**

The studies of Alqueva provide information about economy and the most significant environmental impacts identified for the project. Much of this information is highly uncertain, such as the irrigation plan design, technologies and cultural systems in the context of the agricultural policy in the European Union, the accession of farmers to irrigated areas, the evolution of agricultural prices, water consumptions, the evolution of energy prices and demand, and environmental impacts such as the quality of the water for irrigation, affected by the draining of fertilizing and pesticides.

The relative importance of the impacts were defined in terms of the magnitude and the significance of impacts with a "common scale" assessment, and the information generated did not specify the degree of uncertainty or ignorance associated with the different impacts.

Therefore, these studies acknowledged that the existing knowledge was still insufficient for an appropriate environmental management of the project. However, this was not considered to be an obstacle to the decision-making process.

In conclusion, and as recommended by the mega-project framework, the impacts of Alqueva should have been characterized in terms of their spatial and temporal scales and their intensities, with a knowledge base as complete as possible, based on existing scientific evidence and referring also to their degrees of uncertainty and ignorance.

### **Realization of the project, operation and follow-up**

Given the particular characteristics of the project (phasing of activities, interactive nature of some activities and impacts), it would be desirable to be able to introduce some flexibility in the design, implementation and management of the project, in spatial planning, in the promotion of good agricultural practices and in monitoring the evolution of resources (water quality control, more sensitive ecosystems).

## 5. CONCLUSIONS

In this article we develop a comparative analysis of three decision-making frameworks that are very relevant to the assessment of the sustainability of investment projects.

Although they appeared linked to different areas of activity and with different levels of decision, the three frameworks apply to the evaluation of large and complex investment projects with multidimensional impacts and involving uncertainty and multiple interests, and therefore to the analysis of the sustain

All three models present principles and features that are essentially similar. All of them consider decision-making as the result of a participated process with different phases and steps, involving the integrated evaluation of multiple dimensions of analysis.

They only differ by their focus of concern. The mega-projects framework highlights the importance of ensuring a flexible approach to better deal with uncertainties throughout the decision-making process. The SEA framework has a strong concern with strategic issues, environmental priorities and long-term sustainability. The river basin framework highlights the need to consider integrated deliberative decision processes and to ensure the quality of the evaluation process.

The operational methodologies of the frameworks share the same key stages. In the design phase, a framework of institutional governance and participation should be established, with requirements for information and assessment tools to be used and for the relationships with stakeholders. In the preparation phase, alternative policy options should be analysed and evaluated. However, there are also some specific issues.

In the design phase, the mega-projects framework considers the importance of problem analysis and the need to consider and study a broad range of project alternatives. The SEA framework considers the need of a strategic analysis and of using key factors of decision. The river basin framework uses deliberative processes throughout the different decision stages and considers also the implementation of an information quality assurance protocol.

In the preparation phase, the mega-projects framework also addresses the uncertainties of different nature (market, political, legal). The SEA framework highlights the need for an adequate preparation of the assessment studies of alternative strategic options.

The case study, with the ex-post analysis of the evaluation process of the Alqueva Dam Multipurpose Project according to the methodological frameworks presented, also brings out the limitations of the studies that have been developed for this project.

The process of analysis and evaluation of the Alqueva project had a very informal and iterative nature and did not follow a process of explicit and regulated steps, with criteria, procedures and

generally accepted values. Thus, an institutional governance and participation framework and an information quality assurance protocol, as recommended by the three decision-making frameworks, were not established. Deliberative-type processes, as recommended by the river basin framework, have not been used. They would have been important, especially in a project like this, with great territorial impact and sometimes involving divergent interests and values.

A strategic investment process, such as Alqueva, should have a comparative analysis of major visions for the project, with a broad problem analysis and the use of adequate tools, to suggest how events – economic, social and political – would unfold and interrelate in the future. This is recommended by the mega-project and SEA frameworks but was not carried out in the studies of the project.

The limitations of the scope have affected the preparation of the assessment studies of the strategic development options of the project. Therefore, the results obtained are not clearly demonstrated. In addition, the quality of the information was not accounted for in the process.

Finally, an uncertainty analysis, as recommended in mega-projects framework, would also be necessary with a knowledge base as complete as possible about the most relevant impacts. It should be based on existing scientific evidence and also refer to the degrees of uncertainty and ignorance of the project expected impacts.

So, we may conclude that the most important limitations of the studies of the Alqueva project have been observed in the design phase, at the level of institutional governance and participation and also in the scope of the project and in problem analysis. In the preparation phase, the access to information and existing uncertainties were the main difficulties and affected the development and integration of analyses carried out.

It therefore appears that, although they have different focus of concern, all the decision-making frameworks considered in this paper contribute to identify the main limitations of the studies developed for the project. All of them also provide recommendations for the development of evaluation processes and for more enlightened and sustainable decision-making.

## Notes

1. Partidario (1999) defines SEA as “a systematic, on-going process for evaluating, at the earliest appropriate stage of publicly accountable decision making, the environmental quality, and consequences, of alternative visions and development intentions incorporated in policy, planning, or programme initiatives, ensuring full integration of relevant biophysical, economic, social and political consideration.”
2. ADVISOR – Integrated Evaluation for Sustainable River Basin Governance was a research project funded by the European Commission under the 5th Framework Research Program.
3. Strategies for coping with different kinds of risks (market, technical and operational, institutional/social) should be considered (Miller and Lessard, 2008).
4. These principles remind the principles of “good governance” as established by the European Commission: openness, effectiveness, participation and coherence (CEC, 2001).
5. The assessment framework was developed around seven critical decision factors: safety for air navigation and transportation, natural resources and risks, biodiversity and nature conservation, accessibility, spatial planning, social and economic competitiveness, and financial feasibility.



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