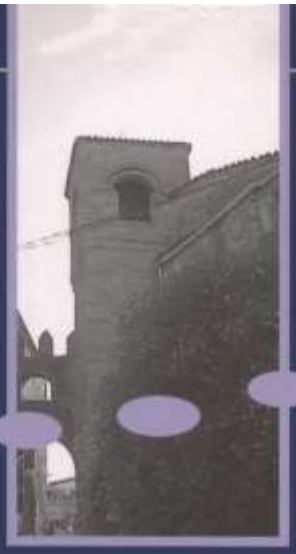

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Tomo II

Coordinadores:
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28
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Multicriteria strategic environmental assessment: A multimethodological proposal

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1.- INTRODUCTION

Strategic Environmental Assessment (SEA), generally understood as the process of Impact Assessment of Plans, Policies and Programmes (PPP), is a way to assess how the different proposals contributes to achieve sustainable development, promoting the integration of sustainability issues on decision-making processes:

> "SEA is 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 considerations." (Partidário, 1999:64).

The concept of sustainable development is commonly seen as the development that meets the needs of present generations without compromising the ability of future generations to meet their needs and aspirations (WCED, 1987). It is also generally understood as the development that must integrate the economic, social and environmental concerns in each decision making process, in order to promote a better quality of life (intra and inter-generations). This means a continuing balance between economic, social and environmental concerns and the use of the existing resources (human and social, natural and economic) taking into account their limits.

In order to fulfil the principles behind the concept and that major objective –to achieve a better quality of life– one believes that:

- the concept of sustainable development is context-dependent, namely in what concerns the social aspects;

- sustainability issues should be taken into account in all the decision making processes related with landscape planning and management, namely land use plans;
- it is at the local level that are better chances of success, once it is the level closest to people;
- land use plans proposals must be assessed, in order to know how much they contribute to achieve (or not) sustainable development.

In this context, it is important to state that the methodologies developed in the field of SEA must go beyond the strict assessment of environmental concerns to generally assess the social and economic concerns as well, in an equitable way. It implies an integrated and trans-disciplinary decision-making process, where an interactive public participation assumes an important role. In one hand, apart from the technical aspects, the methodologies should take into account the empiric knowledge of all the actors involved, in order to establish, in each context, what are the most important values to consider. In the other hand, it is a way to legitimate the decisions taken and to create a shared understanding of a problem and a commitment to action (Phillips, 1990).

The question is "How to develop a methodology to support this socio-technical (Phillips, 1990; Bana e Costa *et al.*, 2001) decision making process?".

The diversity of questions that emerge make clear that a single methodology for SEA is not able to answer to all that questions. The proposal is to combine the Strategic Environmental Assessment Methodology with the Multicriteria Decision Aid Methodology and create a Multicriteria Strategic Environmental Assessment Methodology, having in mind the concept of Multimethodology developed by Mingers (1997) and Mingers e Brocklesby (1997), as described below.

2.- THE CONCEPT OF MULTIMETHODOLOGY

Multimethodology is generally understood as the "art" of going beyond the use of a single methodology to generally combine several methodologies, in whole or in part, and possibly from different paradigms,[1] in order to deal with the richness of the real world (Mingers, 1997; Mingers and Brocklesby, 1997).

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1 "A *paradigm* is a very general set of philosophical assumptions that define the nature of possible research and intervention. (...). We shall distinguish three main paradigms each of which has been referred to by a variety of names: *empirical-analytic* (positivist, objectivist, functionalist, hard), *interpretive* (subjectivist, constructivist, soft), and *critical* (critical systems). A *methodology* is a

It is important to state that the concept of multimethodology is not related with a specific paradigm or methodology, or even to a specific form of combining methodologies. The concept has a broader definition, in the sense that the idea is the possibility of linkage, integration and combination of different methodologies, techniques and tools, from the same paradigm or from different paradigms, in order to answer to problematic situations.

But how do we choose a methodology and which methodologies should be combined to solve a specific problem?

The choice of a methodology (or methodologies) should consider and establish, at the very beginning, which paradigm best fits the problematic situation. Each combination require the knowledge of a multiplicity of methodologies, techniques and tools from different paradigms, and one must feel "comfortable" using them, in order to know which can be applied to which part of the process and understand how is it possible to link them.

This implies a detailed study of the different methodologies to see where the linkages or combinations can occur and which parts can be detached (and with which functions). Implicitly, there is an assumption that the different techniques developed into a specific methodology can be detached and used in another, from the same or different paradigm, without loosing its original function and the reason for it was created. Anyhow, one must be aware that a technique is always developed into a particular methodology and should be seen in the context for which it was created (Mingers, 1997; Mingers and Brocklesby, 1997).

Knowing the cognitive limitations of a single person, this kind of intervention requires a trans-disciplinary teamwork, where the different experts in the different subjects work together in order to get a better understanding of a problem, relate and link their knowledge, with the aim of solving a problematic situation.

In a Strategic Environmental Assessment context, with the aim of assessing how local land use proposals achieve sustainable development, the concept of multimethodology is particularly important: it allows combining the different methodologies and techniques that emerge from the different perspectives of sociology, economy

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structured set of guidelines or activities to assist people in undertaking research or intervention. Generally, a methodology will develop, either implicitly or explicitly, within a particular paradigm and will embody the philosophical assumptions and principles of the paradigm. Usually there is more than one methodology within a paradigm. (...). A *technique* is a specific activity that has a clear and well-defined purpose within the context of a methodology. (...). Finally, a *tool* is an artefact, often computer software, that can be used in performing a particular technique." (Mingers and Brocklesby, 1997: 490).

and ecology (the three main areas of concern of sustainable development) minimizing the difficulties that emerge when using a single SEA methodology. In fact, despite the positive results obtained with the methodologies developed for SEA (*cf.* Thérivel and Partidário, 1996), these methodologies do not give a global answer to all the questions that emerge, particularly in what concerns the procedural and cognitive aspects of the decision-making process.

In this perspective, which methodologies should be used and combined in SEA? Under which paradigm?

3.- THE CONSTRUCTION OF A MULTICRITERIA STRATEGIC ENVIRONMENTAL ASSESSMENT MULTIMETHODOLOGY

According to Rauschmayer (1999), the major problem that arises in the discussion about sustainability is the lack of coherence between the social values, the ecological needs and the economic interests. Most of the times, experts in the different areas of concern, give to the decision-makers the information they need in a separate way. It is the decision-maker who should integrate all the information, usually without the help of the scientific community. Due to the complexity of the problems upon which it is necessary to decide, this process of integration cannot be done in an ad-hoc way. The decision maker needs some techniques and tools (formal ore non-formal) to integrate the elements of the three dimensions. These integration techniques or tools should be developed into the framework of Multicriteria Analysis. In this sense, in this communication the emphasis goes to the Multicriteria Decision Aid methodology (Roy, 1985; Bana e Costa, 1992), as a methodology to combine with SEA, when evaluating local land use proposals.

Eggenberger and Partidário (2000:202) consider SEA a "learning and communicative process which should be developed in such a way as to provide real information and value for decision makers and affected people". More than an evaluation process, SEA is a decision aid process, aiming at giving to the decision maker all the information he needs to make clear and informed decisions.

The two methodological convictions (or paradigms) considered by Bana e Costa and Pirlot (1997) the fundamental pillars of the Multicriteria field, fit perfectly well into the principles of the SEA methodology: the conviction of the interconnection and inseparability of the objective and subjective elements of a decision context and the conviction of constructivism and learning.

The paradigm under which the two methodologies are based upon –the soft learning paradigm– has no problem in what concerns their integration and constitute, for the contrary, an effective and solid basis.

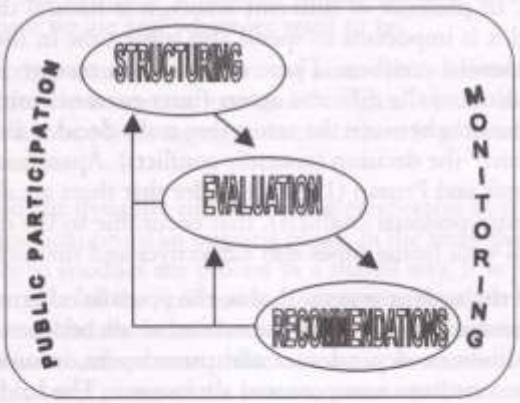
Table 1: Strategic Environmental Assessment Methodology

Context of the PPP and SEA: setting objectives, targets and constraints
Identifying alternative PPP
Describing the PPP
Scoping
Describing the baseline environment (current state)
Establishing environmental indicators
Predicting impacts
Evaluating impacts and comparing alternatives
Mitigation measures
Implementation
Monitoring

Looking at the SEA methodologies developed in the last few years [*cf.* Thérivel and Partidário (1996), Sadler and Verheem (1996) and Thérivel and Brown (1999)], we can see that there are many similarities between them, and say that the SEA methodology is, generally, composed by the following methodological steps.

In the other hand, Bana e Costa (1992) propose a Multicriteria Decision Aid Methodology, developed in three interrelated phases –Structuring, Evaluation and Elaboration of Recommendations– as a learning, interactive and dynamic proces.

Figure 1: Multicriteria Decision Aid Methodology



The *structuring* of a decision problem is essential in the characterization, analysis and diagnosis of the (problematic) situation. The way we state the problem determines the alternatives to consider and their evaluation, which, implicitly, determines the way the decision will be taken:

> "*The way you state the problem (...) represents a crucial choice in its own right. Get it wrong and you'll march out in the wrong direction. Get it right and you'll be well on your way to where you really want to go.* A good solution to a well-posed decision problem is almost always a smarter choice than an excellent solution to a poorly posed one." (Hammond *et al.*, 1999:16).

A correct definition of a problem must go through a participated process, to correctly identify the different values of the different actors involved –the *actors system*, as well as the alternatives to evaluate– the *actions system*, in order to create an interactive and learning evaluation model (Bana e Costa, 1992).

Most of the times, we spend too much time evaluating a problem, without paying the proper attention to its structuring, due to the fact that there is a believe that the problem is always very well defined and structured, and the only thing one must do is to solve it. In fact, the complexity of a problem goes beyond what is said or explained and it is necessary to spend some additional time to understand and "translate" that complexity in a clear and explicit way.

This is particularly important in what concerns the study of the actors system, once we are dealing with personal values, that are, naturally, very subjective. In the participated perspective of the process, it is important to identify, at the very beginning, which actors (directly involved or not). Then, it is important to clarify their values, their main concerns and objectives, that are the basis to the identification of the different alternatives to consider as well as the basis to the construction of an evaluation model. In presence of different actors, it is natural that some conflicts might appear, and it is important to spend also some time in the identification of the existing or potential conflicts. These conflicts can emerge from the different perspectives and values of the different actors (inter-personal conflicts) or from the differences of preferences between the actors that really decide (decision-maker) and the ones who "receive" the decision (systemic conflicts). Apart from these two kinds of conflicts, Bogetoft and Pruzan (1991) consider that there are also personal, individual conflicts (intra-personal conflicts), that occur due to the diversity of aspects a person must deal with (some times also subjectives and themselves in conflict).

In the study of the actions system, that is, the potential alternatives (or options) to evaluate, it is fundamental to study the interrelations between potential alternatives, their compatibilities, dependences and precedences, in order to choose a set of actions that can constitute new potential alternatives. The study of the actions is

so important as the study of the actors, once only through concrete actions it is possible to achieve the proposed objectives.

In SEA, it is in the structuring phase that we must identify the main actors of the process and their main concerns and values, in order to make clear the meaning of sustainable development in each context and the related objectives to achieve, in a participated and shared way. At the same time, it is in this phase that we identify and describe the alternative options, that is, the alternative PPP (including the zero-alternative of "doing nothing"). It is in this phase that we must look at the environmental, social and economic concerns and to the potential alternatives to solve existing problems and avoid potential ones. It is necessary to make a very good and precise characterization of the present/existing situation, with a clear identification of the objectives to fulfil in the different areas of concern and the constraints to their implementation. After all, it is necessary to establish a way to evaluate how the potential alternatives give answers to the objectives identified, through the definition of indicators and impact describers (a set of plausible impact levels), in order to make a partial qualitative appraisal of the potential impact of the proposed actions over the objectives.

The structuring of a problem is very important in order to make it clear and explicit, helping each person to better understand itself and, as a consequence, to achieve a better understanding of the problem between all the actors.

The aim of the *evaluation phase* is to appraise the global value of the potential alternatives over the set of objectives, through an aggregation procedure of the partial appraisal. It means that it is necessary to translate the qualitative appraisal into a quantitative one: the impact describers previously defined must be transformed into value functions, in a common scale that allow a homogeneous quantification of those impacts. Sustainability indicators should be used as reference levels, in order to know where we are and where we want to go.

Once the objectives usually don't have the same relative importance, in order to obtain a global value, it is necessary to give "weights" to the different objectives. Finally, it is possible to apply an aggregation procedure (e.g. an additive model) and calculate a global value.

Having in mind the dynamic and retroactive perspective of the process, the elaboration of recommendations is an ongoing phase, in the sense that occurs during all the process, mainly to conduct the process in a shared way. It is particularly important in the interpretation of the final results, to compare the alternative solutions and choose a feasible one. Usually, it involves some discussion between the actors involved, once the solution to adopt must reflect the main concerns of all actors. It is still possible that, in this latter phase of the process, some conflicts emerge. Some times,

it is necessary to go back to the initial structuring phase and examine carefully the initial value judgements or create new alternatives actions that better answer to the objectives, in order to minimize remaining conflicts. It is in this phase that SEA must look carefully to the potential negative impacts over the set of sustainable development objectives, and propose mitigation measures.

This overview of the Multicriteria Decision Aid Methodology is important to state that it is possible to answer some of the open questions in the SEA methodology, and that it is also possible to combine them. Table 2 shows the relations between the two methodologies and Table 3 shows the final combined methodology, proposed by Ramos (2002).

Table 2: Relations between SEA Methodology and MDA Methodology

Strategic Environmental Assessment	Multicriteria Methodology
Context of PPP and SEA: setting objectives, targets and constraints	STRUCTURING Analysis of the context
Identifying alternative PPP	Identifying the different actors and potential conflicts
	Identify and operationalize values and objectives Identify strategic intervention areas
Describing the PPP	Identify and/or create potential actions Construction of impact descriptors of actions over the objectives Qualitative appraisal of impacts (of actions over the objectives)
Scoping	EVALUATION Building cardinal value functions
Describing the baseline environment (current state)	Partial value of actions over the objectives (quantitative appraisal of impacts)
Establishing environmental indicators	Determining value scores
Predicting impacts	Global value of actions over the global set of objectives
Evaluating impacts and comparing alternatives	RECOMMENDATIONS Interpreting the results
Mitigation measures	Comparing the different alternatives Mitigation measures
Implementation	Choosing an intervention strategy
Monitoring	Sensitivity and robustness analysis

Table 3: Multicriteria Strategic Environmental Assessment Multimethodolgy

STRUCTURING
Analysis of the context in which occurs the plan and the SEA
Decision environment; specification of the scoping of the plan
Baseline environment (current situation)/Specification of environmental, social and economic issues
Creation of data bases; collecting and processing the important information
Identifying different actors involved in the process
Active and passive actors, collective and individuals actors, in the different decision making levels
Studying and identifying values and objectives
Identifying constraints and potential conflicts
Identifying compatibilities, incompatibilities and complementarities between objectives
Selecting intervention strategic areas
Identifying and/or creation of strategic actions
Identifying compatibilities, incompatibilities and complementarities between actions
Operationalise objectives
Impact descriptors of actions over the objectives
Qualitative appraisal of the impact of actions over the objectives
EVALUATION
Building cardinal value functions
Predicting and evaluating partial impacts
Assessing "weights" to each objective
Aggregating partial values
RECOMMENDATIONS – OPERACIONALIZATION / IMPLEMENTATION
Comparing alternative proposals and strategic options
Decision and choice of a strategy
Sensitivity and robustness analysis
Making recommendations
Considerations about the chosen strategy
Mitigation measures of conflicts and negative impacts
Monitoring

The two methodologies are complementary and, from its combination under the soft paradigm of learning, a Multicriteria Strategic Environmental Assessment Multimethodolgy is created (Table 3).

The methodological steps are defined but, due to the complexity of the process, this combination of methodologies is not enough to answer all the questions that emerge, namely those related with the structuring phase, where the aim is to

identify and structure the values of the different actors involved, to identify the potential alternative options and to study their inter-relations, compatibilities and complementarities.

In this sense, one needs to use some additional techniques and tools, as a complement to improve the proposed methodology, coming into another type of multimethodology (Mingers, 1997 and Mingers and Brocklesby, 1997): *methodological enhancement*.

Having in mind the participated and interactive nature of the process, in the structuring phase, in order to clarify the values of each actor, we can use the additional technique of *cognitive mapping*[2] (Eden, 1989; Eden and Ackerman, 1998) supported by the software Decision Explorer (Banxia, Software Ltd., 1997). To help in the structuring of the alternative options, we can use the AIDA technique[3] (Friend, 1989; Friend and Hickling, 1987), supported by the software STRAD – Strategic Adviser (Friend, 1994).

In the evaluation phase, we can use the *MACBETH* approach[4] developed by Bana e Costa and Vansnick (1995, 1997, 1999, 2000) in the construction of cardinal value functions, as well as to assign weights to the different objectives.

Finally, in the recommendations phase, to help in the decision making itself, software *EQUITY*[5] (Barclay, 1988) can be used to resources allocation through a cost-benefit analysis.

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2 A cognitive map is a technique to help to represent the values of the different actors, in a graphical way, to create a common language. A map represents what means a concept by its relation with the other concepts.

3 In the AIDA technique (Analysis of Interconnected Decision Areas), the objective is to identify the compatibilities, incompatibilities and precedences between alternatives options.

4 MACBETH (Measuring Attractiveness by a Cathegorical Based Evaluation Technique) is an interactive approach, supported in a Decision Support System, to quantify the differences of attractivity between impact levels, based on semantic judgements. MACBETH proposes a semantic scale of six categories of differences of attractivity, from weak to extreme, to help the evaluator in the qualitative appraisal about the difference of attractivity between two (and only two) impact levels. Upon the value judgments made by the evaluator, MACBETH proposes a numerical scale, determined by linear programming.

5 Having the costs and the benefits of all the alternatives options, EQUITY identifies the strategies (combination of alternative options) that maximizes the ratio total benefit / total cost. Graphically, these strategies constitute the efficient frontier of the area where all the other strategies are included. If a chosen strategy is not in the efficient frontier, EQUITY identifies two alternative strategies: one with the same cost and more benefit; and another one with the same benefit and less cost.

With the help of these complementary techniques and tools, it is possible to minimize some of the problems that the methodology, by itself, is not able to answer. All the techniques are supported in interactive tools that enables the visualization of all the process, and provides a framework to establish a common language between actors.

4.- CONCLUSIONS

Strategic Environmental Assessment has already proved its importance in what concerns the assessment of potential environmental impacts of Plans, Programmes or Policies. Nevertheless, in the context of SEA as a way to achieve sustainable development, SEA can be improved if the emphasis goes to the study, in an equitable way, of the three main areas of concern of sustainability (economy, ecology and sociology) and not only centred in environmental concerns. In the other hand, due to the participated and interactive nature of the process, it is also necessary to pay more attention to the procedural aspects of the methodology, apart from the technical ones.

In this context, the development of a SEA methodology that deals with these aspects, will find some benefits in the Multicriteria Decision Aid methodology, which deals with the complexity of the process, taking into account, simultaneously, the objective and subjective aspects. It happens, very often, that complexity is more related with the interaction between the different actors involved (and their intrinsic values) than with the decision itself.

The proposal is the combination of the two methodologies, under the soft paradigm of learning, coming into the core of the multimethodologies. Once this combination is not enough to answer all the questions that emerge, it is necessary to appeal to other techniques and tools to overpass the problems that each methodology, technique and tool can not solve by itself. In fact, the mixed approaches are more flexible and effective in the resolution of complex problems, than each methodology, technique and tool by itself. They are all very important individually but they don't answer individually to all the questions. Once they have different strengths and weaknesses, using them as a complementary set allows addressing different problem situations. This methodological procedure is also important, once allows to work each question individually, to facilitate the value judgements, but never forgets the inter-relations between the economic, environmental and social aspects. Through an aggregation procedure, one can have a global vision of the problem, with the objective of giving to the decision maker all the information he needs to decide in a conscientious and informed way.

The use of interactive tools enables the visualization of all the process, and provides a framework to establish a common language between actors. Simultaneously, facilitates all the analysis during the process, in such a way that the person who is conducting the study (the facilitator) works with the different actors and not for them, creating a shared understanding and a commitment that legitimates the decisions taken.

We can ask why have we chosen these methodologies, techniques and tools? The answer is because they have in common the main purpose of minimizing the complexity of a problem, namely the subjective aspects related with the value judgements of each actor. They were developed under the soft paradigm of learning, in order to help to structure a problem in such a way that the result can be an evaluation model shared by everyone.

Finally, it is important to say that the methodologies, techniques and tools above referred can not be taken as a "recipe" to the resolution of all the complex problems, and only constitute valuable alternatives that must be considered according to each situation and context. Some other techniques or tools can be used and some other combinations are possible

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