

STRATEGIC ENVIRONMENTAL ASSESSMENT: THE NEED TO TRANSFORM THE ENVIRONMENTAL ASSESSMENT PARADIGMS*

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Strategic Environmental Assessment (SEA) needs to develop its own theoretical ground and its related concepts to be able to address the challenges of environmentally improving complex strategic decisions such as policies, plans and programmes (PPP). According to its conceptual specificity, SEA requires an autonomous methodology. Its main feature is that it must be able to dialogue with the decision-making process to ensure the decision related environmental values are duly taken into account. This paper proposes two linked concepts that could help to set up an autonomous conceptual ground for the SEA: The concept of consistency requirements of decisions and the concept of decision related environmental values.

In addition, SEA needs to identify the specific environmental dimension of strategic decisions. The concept of environmental impact describes perfectly the environmental dimension of projects. This paper proposes the concept of the **sectorial environmental system** as the genuine representation of the strategic environmental dimension of strategic decisions and therefore as the key target for SEA activities.

Keywords: Strategic Environmental Assessment; environmental value; environmental system.

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Introduction

The SEA needs its own theoretical and conceptual framework to distance itself from the concepts and models of the Environmental Impact Assessment (EIA) of projects, in order to be able to address the challenges of environmentally improving complex strategic decisions such as policies, plans and programmes (PPP). One of the objectives of this paper is to contribute to such framework. The aim is to define a purpose for SEA that will distinguish it from other support tools for strategic decision-making. Instead of taking into account the environmental consequences of decisions, this article postulates that the objective of the SEA is to incorporate environmental value in decision-making.

According to this above stated objective, SEA requires a particular methodology, i.e. an articulated set of steps to achieve its main objective, which is to encourage the incorporation of environmental values into the strategic decisions. SEA practice must distance itself from the EIA traditional methodologies targeted to assessing products of decision processes, which are already in their final stages. SEA must develop methodologies to deal with complex and non-linear processes, which often lack an explicit decision-making logic. This article proposes an SEA methodology that respects its distinguishing purpose and that is able to address the diversity of the decision-making processes and to encourage their incremental environmental improvement.

Finally, SEA needs to describe precisely the strategic environmental dimension of strategic decisions to differentiate itself from the EIA of projects. The environmental dimension of a project can be addressed through a simple model, which relates a specific project to the environment through linear vectors of impact. This article outlines the basics of the **strategic environmental dimension of strategic decision**, using new and more complex models based on a systemic methodology. The output of this modelling process is referred to as the **sectorial environmental system**. It provides a representation of the strategic environmental dimension of the strategic decisions and must be considered as a key tool of the SEA process.

SEA: An Evolving Tool

Many SEA definitions (Therivel *et al.*, 1992; Therivel and Partidario, 1996; Dalal-Clayton and Sadler, 2005) such as Sadler and Verheem's, often cited in literature, centre the strategic environmental assessment on the consideration of the environmental consequences of decisions. "The strategic environmental assessment is the systemic process of studying and anticipating the environmental consequences of proposed initiatives at high level decision-making. The purpose of the process is to incorporate the environmental criteria from the beginning, as an element of

decision in all the sectors and degrees of planning, placing it at the same level as the economical and social criteria.” (Sadler and Veheem, 1996). More recent definitions from Verheem himself (Verheem and Tonk, 2000) have partially modified this perspective.

All the definitions mentioned above states that the strategic environmental assessment is a procedure to study the environmental consequences of policies, plans and programmes and to incorporate these environmental consequences into the decision. This standard definition identifies the environmental criteria, that have to inform decisions, with the environmental consequences of decisions.

The immediate conclusion derived from this consequentialist understanding of the purpose of SEA is that the analytical objects of the strategic environmental assessment are the environmental effects or impacts of the PPP. In other words, from a methodological point of view, the SEA must provide analytical tools able to foresee the likely effects or consequences of strategic decisions and hopefully quantify them.

However, SEA is increasingly understood as a process aimed at improving the decision-making processes from an environmental perspective (Jiliberto, 2002, 2004a, 2004b; Bina, forthcoming; Brown and Therivel, 2000). A more recent definition proposed by the World Bank reflects well this trend, according to which the SEA is a “participative approach to place the environmental and social aspects in the centre of the decision-making process and to influence in the development planning, the decision-making and the implementation processes at a strategic level” (Mercier, 2004). Moreover Bina (Bina, forthcoming) has already identified three stages in the evolution of SEA being the last one characterised by the trend to integrate SEA and the decision-making.

There still is, however, an obstacle between the conceptual evolution of SEA and its practice. A new conceptualization requires a new methodological approach. In this respect the most important challenge for SEA experts and scholars is to overcome the dominant paradigm, according to which, any environmental assessment consists in feeding a decision with information as objective as possible, about the probable future environmental consequences of the assessed decision.

Stretching SEA’s Horizon

This dominant paradigm in environmental assessment poses a serious problem. On the one hand, it indicates that SEA’s objective is to estimate the environmental effects of a strategic decision, and on the other hand, the practice focuses on identifying effects of likely effects of the projects that will be developed as a result of the strategic decision.

SEA practice dedicates most of its efforts and large amounts of resources to simulate a future scenario to be able to identify the subsequent actions, the projects that it will cause. A recent SEA guide states this quite precisely, “The first requisite is to identify the expected outcomes of implementing each element of the programme or plan” (Scott and Marsden, 2003). The purpose is to create a listing of expected outcomes of the plan or programme and subsequently to estimate their environmental effects. As sometimes this effort is not even possible, it is openly acknowledged that “. . .the effects estimation must be stopped. . . somewhere halfway down the effects chain” (EC, 1994).

This paper argues that predicting multiple layers of decisions deriving from the strategic PPP in question, is not the intrinsic objective of the strategic decisions subject to SEA. Further more it postulates that such decisions are intended to generate strategic decision frameworks, which are consistent with strategic objectives, in order to improve a given state of things, from a long-term perspective.

In some cases such as certain strategic decisions, like strategies and plans, the lower hierarchical decisions simply are not part of the decision. These instruments are composed of policy guidelines and criteria. An example could be the national or regional sustainable development strategies, certain town, or urban planning, or even national energy plans.

In other cases, even if the lower hierarchical decisions do not form part of the decision, they are part of the decision process in order to facilitate a feasibility analysis of the strategic decision options. This is the case of certain hydrological plans, and regional development strategies. In other words, the lower hierarchical decisions, or the projects, are incorporated into the strategic decision-making process in order to make the decision more tangible and to be able to decide whether it is generally speaking feasible or not. It is often the case that during the implementation of the plan, for opportunity reasons, the lower hierarchical decisions differ from the ones used in the decision-making process to assess the plan feasibility.

Finally, in some cases, these lower decisions, such as projects, are part of the final decision. However, they are available when the decision-making process is well advanced and they are available only at a low scale of design. This is usually the case with certain programmes, like multi-mode transport plan.

Thus, the lower hierarchical decisions, such as projects, are not substantially part of the strategic decision, or they are available at a level even less detailed than that of a pre-feasibility study. This means that it is not possible to make accurate estimate about the future environmental effects of these projects. Furthermore, this approach does not address the specific strategic environmental dimension of PPP. It is argued here that there are three reasons why the uncertainty of such estimated effects or impacts makes it inadequate to centre the environmental assessment of the strategic decision on such information.

First, the degree of uncertainty of the information about the hypothetical future consequences of the PPP means that the prediction of such consequences is a rather weak output of the environmental assessment of a PPP. The information on which they are based is often inadequate, or insufficient.

Second, the policies, plans and programmes are social decision-making processes, which cannot be optimized by improving the products they generate, after the decision on such PPPs has been taken. The environmental effects of the decision can only be estimated when the decisions have reached a high degree of detail to facilitate the prediction of its environmental effects. However at this stage given the political and social nature of strategic decisions not much can be changed. Even if it would be possible to have certain information of the likely effects of the decision the policy process would make impossible to introduce significant changes on it.

Third, a quick glance into SEA practices and legislation (see the EU Directive 2001/42/CE; EC, 2001) reveals that generally they intend to address environmental dimensions, which go beyond the environmental effects of a PPP. For instance, in some SEA it is equally important to identify the environmental consequences of a plan to ensure the consideration of all the possible and feasible alternatives. In other occasions, it will be equally important to establish whether the effect on the water quality is going to be high or low, as to ensure that the estimation of the social demand underlying the plan is estimated correctly. Therefore, an SEA centred exclusively on the environmental consequences does not allow configuring a methodology which incorporates the whole set of concerns that lead an SEA.

Decision Related Environmental Values and Consistency Requirements of Decisions

If, as has been argued above, SEA can no longer be defined simply as a procedure to incorporate the environmental consequences in decision-making, then it is necessary to ask which will be the core concept of a strategic environmental assessment. Practice can provide an insight on this.

In SEA practice the issues that matter tend to be much more diverse, compared to the single focus on likely environmental effects. For instance, it is important to establish whether the social demand calculations used to define investments for a PPP were properly calculated. Similarly, it matters whether the right environmental information is being incorporated in the decision process, since this is to be used to identify alternatives, estimate the environmental effects of the alternatives, amongst many others (EC, 2001).

The common denominator of what matters is that they are requirements, or conditions, the strategic decisions must meet, because in doing so they will become more environmentally satisfying.

For instance, it is relevant from an environmental point of view that the decision takes into account all relevant alternatives. Therefore, it is important that the decision maker does not omit an alternative, otherwise it could be the case that he/she is omitting an alternative, which at the same time that complies with other criteria, has a better environmental profile. This comprehensiveness is considered here as a consistency requirement for the decision-making process. It is an example of decision-making process requirements that are referred here as “consistency requirement of decisions”. They are a normative instruction, which means they are based on norms, principles and values about how the decision-making processes must be carried out (Jiliberto, 2002).

Some consistency requirements of decisions include the following:

- availability of environmental and/or sustainability policy criteria
- appropriate environmental information
- logical structure of the decision-making process
- appropriate public participation
- sufficient identification and definition of alternatives
- sufficient identification and definition of environmental criteria for evaluating the alternatives
- consistent selection of the alternative, and
- ex-post review and iteration of the decision-making process

The requirements listed above simply mean, for instance, that society considers a relevant environmental value taking into consideration all the possible alternatives, the environmentally friendly ones as well as the alternatives of no action, when taking strategic decisions.

The strategic environmental assessment is a process intended to improve the consistency of the decision-making process from an environmental perspective, by promoting the application of the consistency requirements of decisions specific for the decision context assessed. The consistency requirements of decisions are specific to every society and change over time.¹

At the root of the consistency requirements of decisions, we can find the dominant values at a given time in a society. Those values are, on the one hand side, environmental value, and on the other hand side, value about how decision must

¹This article follows Faludi's approach to the role of rationality in planning. Public decision-making are required to follow rational rules. This does not mean that they are rational. Some degree of procedural and substantive rationality are always behind the decision related requirement one can identified in any SEA process (Faludi, 1987).

be taken, or decisional values. Behind every consistency requirement is an environmental value that use a decision value to ensure its consideration in decision-making. For instance, the consideration of all relevant alternatives is a decisional value that is considered in SEA, because its application promotes the consideration of environmental values in the decision-making process. It is not just applied to improve decision quality as such. The environmental values acquire in a decision context a specific format. They adopt the form of a decision related environmental value.

Once we have clarified this, it is possible to define the SEA objective: The objective of SEA is to facilitate the incorporation of decision related environmental values into the strategic decisions (Jiliberto, 2002).

The idea of the SEA being related to the way in which decision related values are incorporated into the strategic decision-making totally changes the assessment scenario. The SEA has in this case as a unique scenario, the decision-making process, because the aim is to incorporate those values into the process in a concrete way.

This implies the need to methodologically redefine the SEA. This important challenge is what the ANSEA European project has tried to accomplish (Caratti *et al.*, 2004).

This reorientation places the decision processes at the centre of the SEA, which assumes the particular characteristics and complexity of such process. This means that the SEA will depend, in each case, on the specific conditions under which the decision-making process takes place.

Strategic decision-making is complex and does not respond to a linear logic, but rather to a fairly chaotic logic that is not always easy to follow, and it is fairly reluctant to be subject to procedural rules, no matter how well founded these are. This is a challenge for the SEA.

The SEA cannot be understood as a 'rationally founded' process to bring decision making to an optimum state (however one defines this), but as a process to identify the possible progressive improvement which can be achieved here and now.

A successful SEA, from the point of view of this article, is not about providing data or certainty about future effects, but an SEA capable of introducing new decision dynamics more consistent with the environmental and decision related values shown by society at the time it is being applied.

Integration of the SEA into the Decision-Making Process

SEA methodology should focus on the decision-making process with the objective to help in incorporating a set of specific decision related environmental values in it.

In this perspective SEA's tasks become planning tasks, which provide support to the planning process in order to better incorporate its environmental dimension. As

such, they are included into the development process of the policy, plan, programme or strategic decision and must be coordinated with the rest of the planning tasks. One of its first tasks is to identify that decision related environmental value relevant for the specific PPP at stake.

We can integrate many of the SEA's tasks completely into the decision-making process, without any need to distinguish one from another. However, if we place ourselves in the current scenario, in which there is a social demand for an SEA procedure like the one expected under the SEA European Directive (EU 2001), including external auditing activities, it is advisable to define a independent set of SEA activities within the decision-making process. This independent set of SEA activities can be called SEA programme.

Such SEA programme of a PPP would have it own specific tasks, products and procedures. The SEA programme identifies a set of tasks, products, and phases that must be coordinated within the decision-making process. However, the SEA programme must also include the obligations and responsibilities of the external administrative SEA procedure, if legally required as by the European Directive, for instance. Figure 1 shows this revised logic of an SEA process.

The SEA's phases organise the SEA's tasks, which belong to the team or the designated person in charge of the SEA within the decision-making process.

The centre column in the above illustration depicts the SEA phases and their contents. The left column shows the relationship of the SEA phase with other planning activities, and the right column shows the SEA products that become part of the plan itself.

The interrelationships between the SEA activities and the rest of the planning activities are diverse. The general logic that determines the relationship of the SEA from the rest other planning tasks is as follows:

- The SEA Strategic Framework PHASE defines the reference framework to incorporate the decision related environmental value into the plan. In this phase, among other operative SEA tasks, we identify the decision related environmental values valid for the PPP at the stake. What the next SEA phases do is to develop the tools for their consideration and assessment and to provide the inputs for the administrative SEA procedure, in the case that there is a legally binding administrative SEA procedure, which need to be feed with specific products, like the environmental report in the case of the SEA European Directive.
- The SEA Scope PHASE involved negotiating the Strategic Framework, first with the internal agents and later with agents external to the planning process, which basically are those defined by the SEA's procedure. In this phase, we define the terms of reference about how to incorporate the environmental dimension into

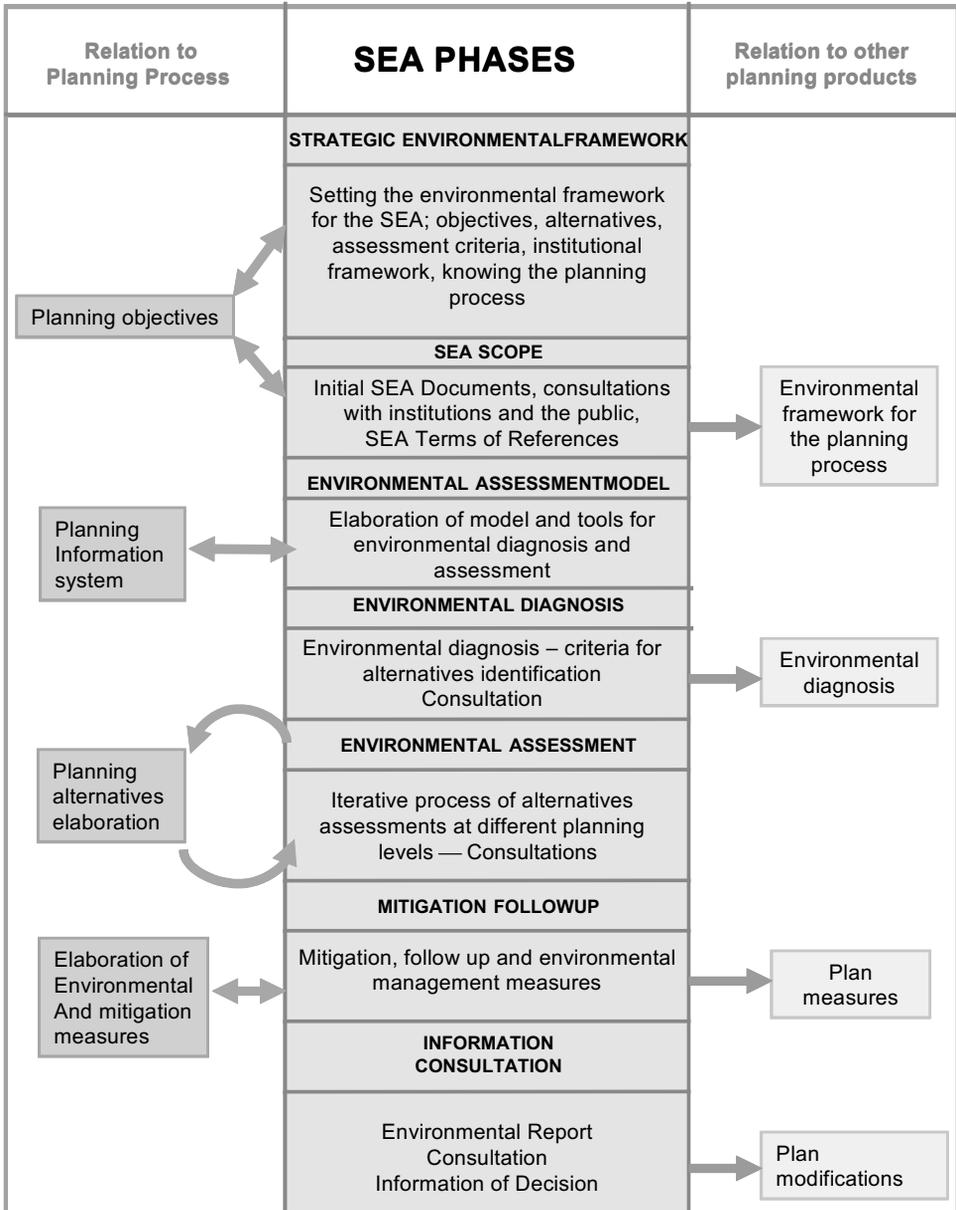


Fig. 1. SEA phases.

Source: Final report of the Strategic Environmental Study for Forest Planning, Ministry of Environment, Spain 2005.

the plan and how to carry out the information and the participation of the SEA's procedure.

- The Environmental Assessment Model PHASE involves the preparation of the analysis and environmental assessment tools for the plan. In this phase, we design and develop the sectorial environmental system and other assessment tools we need for the assessment.
- In the Environmental Analysis and Diagnostic PHASE, we carry out the environmental analysis and diagnostic out using the developed tools in the previous phase. Analysis and Diagnostics must be a reference to identify the environmental issue the plan must take into account in its proposals. This environmental diagnostic becomes an integral part of the plan.
- Up to this point, the SEA enables the planning process to have a strategic vision of the environmental issues, which must be addressed. In the Environmental Assessment of Alternatives PHASE, the SEA helps in assessing the alternative options formulated to achieve the environmental sustainability objectives of the plan. This environmental assessment of alternatives takes place at different times and scales of the planning process. This activity is, usually, of an iterative nature and the developed assessment instruments are used recursively.
- In the Prevention and Follow-up PHASE, the SEA must design the preventive measures, the direct environmental management measures and the follow-up plan. These measures are incorporated into the plan.
- Finally, the Information and Consultation PHASE is in charge of the participation and information processes, both those required by law and those advisable in order to appropriately carry out the SEA. Consultation takes place several times along the decision-making process.²

This SEA's methodology introduces several changes in comparison to common approaches: (Office of the Deputy Prime Minister, 2003; Scott and Marsden 2003).

- The SEA's phases are not steps to follow up an administrative assessment procedure. Instead, they are meant to make possible the incorporation of the strategic environmental dimension in the decision-making and additionally, so as to comply with an administrative procedure. The SEA is a working programme within the planning process.

²Direct environmental management measures are meant here as at the plan or programme level relevant direct measures to mitigate the environmental impact of sectorial activities, either of technological or non technological nature; like new environmentally friendly technologies, procedures, or actions, which make sense that the plan or programme promotes or assumes.

- The SEA products are part of the planning process and of the PPP; they are the basis for the documentation of the SEA process to be presented outside the planning process.
- The SEA tasks are intrinsically planning tasks. The definition of the environmental assessment model, the environmental diagnostic and analysis, even the environmental assessment itself and the definition of direct environmental management measures, are all tasks that must help in generating an environmentally sustainable plan and are a clear benefit to the planning process.
- The SEA tasks have become independent from the rest of the planning task in an autonomous working plan assigned to a person or a group in charge of carrying it out, this is the way to achieve normative objectives inside the complex and chaotic decision-making processes, such as policies, plans and programmes. If it becomes a struggle to incorporate procedural environmental criteria into a process (especially as this usually lacks a linear procedural structure), then it becomes necessary to appoint an agent able to represent the SEA programme and dynamically interact with the process, providing a clear working programme logically structured.

The team in charge of the SEA inside the strategic decision-making process does not have just one role in the process; on the contrary, in each PHASE they carry out a range of tasks, as shown in Table 1.

In each one of the phases the SEA team carries out different types of activities, whether it is, for instance, creating products of the planning process, developing the environmental diagnosis, feeding other planning activities, for example, environmentally assessing the alternative options or feeding the SEA's procedure, for example, generating a report for public participation.

Table 1. Roles of SEA responsible.

SEA Phases	Role of SEA Responsible
Strategic Environmental Framework	Planner-Prescription
SEA Scope	Negotiator
Environmental Assessment Model	Planner
Environmental Diagnosis	Planner
Environmental Assessment	Assessor
Mitigation-Follow up	Planner
Information-Consultation	Assessor

Source: Final report of the Strategic Environmental Study for Forest Planning, Ministry of Environment, Spain 2005.

The Strategic Environmental Dimension of the PPP

Of all the consistency requirements of decisions demanded of a PPP from the SEA, maybe the most difficult to operationalise is the one that requires environmental criteria to assess the alternatives. This difficulty is partly due to the understanding, according to which, the SEA needs to use the same environmental criteria to assess the alternatives as the ones used by the EIA, i.e. the environmental impacts, as they are known and conceptualized. This requires a deep review.

The estimation of the environmental effects of a strategic decision is, without any doubt, an important element of any SEA. The correct time to assess the environmental effects during a decision-making process is when choosing from amongst alternative options. The environmental effects, as well as the economic, technical and social effects that the different alternative options present are used as selection criteria, and the alternative to be chosen will be the one with the better balance between them all.

In a strategic decision-making process the alternatives are assessed at different moments, here we consider at least three: the first moment, when the objectives for the PPP are set, the second moment, when the strategy to be followed to achieve those objectives is set, and the third moment, when the strategy is developed in operative measures. For each one of these levels different environmental criteria are required, as the environmental aspect in each one of them has a different degree of abstraction or generality.

Alternative options at any level of decision are compared with each other according to economic, environmental, social, territorial and other criteria. Therefore, at this decision related point the SEA must provide criteria, which allow the assessment of the possible environmental effect of each alternative. Under the pressing influence of the EIA practice, the SEA is prone to use the same environmental criteria used to assess alternatives at project level. Most SEAs consider that the appropriate criteria to assess alternatives are their environmental impacts, in most of the cases measured by conventional environmental indicators such as emissions into the atmosphere, into the water, etc. The underlying concept is that the effect estimation consists in describing hopefully quantitatively or qualitatively the linear relation between the PPP and each of the different vectors of the environment. (Many available SEA guidelines illustrate this procedure, Office of the Deputy Prime Minister, 2005, Scott and Marsden, 2003).³

³ A good reference for this statements are the impact criteria proposed by the Spanish Environmental Ministry in the Reference Document for the SEA of the European Operative Programme and the Cohesions Funds. Available at the web: http://www.mma.es/portal/secciones/evaluacion_ambiental/planes_programas/planes_ea/peh1706.htm.

This understanding of the assessment of the environmental profile of alternatives hides their actual environmental dimension. Such dimension is not the equivalent of the environmental dimension of a single project or of the simple sum of the impacts of the hypothetical projects a PPP enables.

Policies, plans and programmes have a specific strategic environmental dimension, which needs to be identified through the SEA process, so as to assess it.

The environmental dimension of single sectorial activities is well known and documented. This dimension comes from the link between a sector activity — and the environmental impacts that it generates. Each type of activity in a given sector, such as applying phytosanitary products, reforestation, felling, etc, within the forest sector for instance, has an environmental dimension. Applying phytosanitary products in a forested area has a rather well known effect to water, solid, biodiversity, and so on. This environmental dimension of those activities is the assessment framework when it is a forestry project at stake and it defines the set of issues the environmental impact assessment of a forestry project must deal with. If the environmental dimension of each one of the project activities is appropriately considered, the project will be environmentally sound.

The strategic environmental dimension of a plan or a programme is different and the difference lies in its strategic nature. A plan or programme leads to decisions made in several matters, the scope of which goes beyond the mere project programming. Generally, plans and programmes tend to address the set of issues, which condition at medium and long term the fate of the sector, or the policy issue at the stake.

A strategic decision is an intervention that intends to bring long term coherence upon the structural conditionings of a sector in order to make it more efficient from the involved agents' and society's point of view. Then, the greater capability a decision has to develop a structural vision, the greater will be its capacity to modifying behaviours.

This is the same perspective one has to adopt in order to analyze the environmental dimension of a strategic decision. It also has to look strategically towards the sector environmental profile. It has to ask itself, which are the current structural conditionings according to which its activities have a profile that generated desirable or undesirable environmental effects.

The relevant question that the SEA should ask is if the PPP has given an account of the structural conditions which would ensure that the sector has a reasonable environmental profile in the future, or at least a better one than the current.

The relationship “sectorial activity-environmental effect” is the last visible chain of a structure, which conditions in a systemic way the sectorial environmental performance whole. A decision with a strategic perspective does not

address the immediate cause of a desirable (or undesirable) effect, but the structure behind it, because it is this structure or this system, which generates it recurrently.

The simple example of forests fires could help to illustrate this idea. A reactive decision in the forest sector would deal with how to extinguish the fires; a strategic and proactive decision would deal with the structural causes behind the fires, rural abandonment, economical incentives to certain silviculture practices, etc. The strategic planning must adopt a structural point of view.

The environmental dimension of a strategic decision lies in the systemic pattern, which determines and explains the current state of the environmental effects generated by the sector as a whole.

In order to describe this pattern it is not enough to explain the environmental effects of the activities carried out in the forest or in the transport sector, just to mention a few examples. It is necessary to have a clear understanding of the elements that play a relevant systemic role in the sector. These elements might be its legal framework and policy tools and the way these tools and framework has conditioned those practices, or the available sectorial institutions and their current capabilities, the existing values, the policy options that have been applied in the past and their results, etc. We call this systemic explanation of the environmental strategic dimension of a PPP the **Sectorial Environmental System**.

The assessment of alternatives within the SEA framework must use its own assessment criteria different from the classical criteria of the EIA, which must be able to account for the strategic environmental dimension of what is being built. To do so it is necessary to have models describing it in a reasonable and operative way. These models are addressed next.

Sectorial Environmental System

We need new representation instruments to be able to understand the pattern behind the environmental profile of a policy sector. Those models require the use of concepts and tools, which allow representation of all the elements, which determine the sectorial behaviour and their mutual relationships, i.e. allow revealing and describing the **Sectorial Environmental System**, which is relevant to SEA practice.

The next section presents an example of **sectorial environmental systems**, which illustrates this approach: it refers to the model used in the SEA for the Transport and Infrastructure Strategic Plan (TISP) from Spain (Fomento 2004).

The Transport-Environment-Territory System (TET)⁴

The environmental assessment of the TISP was not primarily focused on the environmental effects and consequences of the transport activities, but was intended to determine and evaluate the environmental effects and consequences of the strategic alternatives. The relevant question for the SEA was if the TISP alternatives changed or did not change the systemic pattern that drives the current relation between the transport, the environment and the territory.

For this analytical purpose the *Transport – Environment – Territory (TET) System* was developed. *The TET* is based on system thinking and analysis. It models the *system*, which emerges from relating three elements relevant for the SEA of a transport plan: the policy instruments, the transport system elements and the environmental consequences of the transport activities. In the modelling carried out, a special relevance has been given to the territorial elements and factors, which are considered vital not only from the transport system point of view, but for their environmental implications. Table 2 describes the different components of the TET:

We base the modelled TET system on a simple causal relationship logic, which is depicted in the Fig. 2.

The transport policy instruments affect the elements of the transport system. The elements of the transport system cause environmental and territorial effects. The transport system elements influence each other creating feedback loops. Some of those loops feed again some policy instrument, the loop is closed and the system logic starts again.

This model includes 82 relationships between the elements of the Transport – Environment – Territory system; each one of them has been analyzed using as reference international comparative sources, as well as the documentation of the TISP diagnostic and other studies. The number of relationships depicted in this case could have been higher. For pragmatic reasons this figure was kept as low as possible.

Each pair of relationships was characterized as reinforcing or compensating the negative environmental and territorial effects of the transport system. For instance, the relation ‘road investment incentivates use of private car was considering reinforcing the negative environmental consequences of the system. The contrary, the relation ‘generation of network and nodes favours public transport’ was characterised as compensating the negative environmental consequences of the system.

⁴The detailed document of the TISP’s Environmental Sustainability Report elaborated within its SEA is available from the Spanish Ministry of Public Works Web page: <http://peit.cedex.es/>. The author of this article was the Technical Director of this report.

Table 2. TET's System components.

Policy Instruments	Transport Elements	Environmental-territorial consequences
<input type="checkbox"/> Investments on non modal infrastructures	<input type="checkbox"/> Balanced modal split	<input type="checkbox"/> Global emissions
<input type="checkbox"/> Investments on modal infrastructures	<input type="checkbox"/> Balance provision of modal infrastructures	<input type="checkbox"/> Regional and local emissions
<input type="checkbox"/> Security and maintenance expenses	<input type="checkbox"/> Territorial distribution of infrastructures	<input type="checkbox"/> Level of noise
<input type="checkbox"/> Promotion of public transport	<input type="checkbox"/> Redundancy of infrastructures	<input type="checkbox"/> Waste production
<input type="checkbox"/> Improvement of transport services	<input type="checkbox"/> Social demand for infrastructures	<input type="checkbox"/> Barrier effect of infrastructures
<input type="checkbox"/> Investments in R + D + i	<input type="checkbox"/> Hierarchical structure of networks and hubs	<input type="checkbox"/> Energy and natural resources consumption
<input type="checkbox"/> Direct management of environmental effects	<input type="checkbox"/> System saturation	<input type="checkbox"/> Effects on natural spaces and biodiversity
<input type="checkbox"/> Market instruments	<input type="checkbox"/> Development of transport services	<input type="checkbox"/> Land fragmentation
<input type="checkbox"/> Planning	<input type="checkbox"/> Efficient use of system's resources	<input type="checkbox"/> Land disarticulation
	<input type="checkbox"/> Internalization of social costs	<input type="checkbox"/> Accident
	<input type="checkbox"/> Update of private profitability by modes	
	<input type="checkbox"/> Infrastructures social profitability threshold	

Source: TISP Environmental Sustainability Report. Ministry of Public Works, Spain 2004.

The environmental balance of the TET system relies on balance between their compensating and reinforcing relationships, so if all of them have a reasonable operation and performance it could be said that the system is on a sustainable environmental balance.

The graphical result of this exercise is the map of Fig. 3.

The policy instruments are represented as a rectangle and placed on the edges of the system. In the centre, we find the elements of the transport system and their reciprocal effects. At the bottom of the figure, there are the environmental effects.

in the SEA of the TISP. What matters; is how it has been able to address the current negative profile of the system, and if possible to reduce it.

The strategic environmental assessment of the TISP analysed the current state of the TET system to create an evidence of the system state that should be the reference for the plan design. The key assessment question is how the plan addresses the current critical situation.

This map is one of several maps produced by the TET system. Its elaboration has a qualitative nature. It has been based on the review of a large quantity of documentation and statistics regarding the transport system in Spain, and has been discussed and evaluated by experts. The model provides simple quantitative indicators, which allow obtaining an aggregated vision of the system.⁵

A systemic model like this one can be generated from very different perspectives. For this reason, it is necessary to clarify the perspective chosen in each case. The general logic, which has guided the construction of the TET system, is the following:

- ❑ The environmental effects depend a great deal on the efficient use of the system's resources. This efficiency is what diminishes the environmental effects, these are considered inherent to transport activities.
- ❑ The efficiency is the result of the modal distribution of transport, of the state of the services and of a balanced territorial distribution of infrastructures.
- ❑ The modal split depends on the balanced modal distribution of infrastructures, the use of public transport and the duplication of infrastructures.
- ❑ The investments in infrastructures are the key factor in the modal distribution of infrastructures and its duplication.
- ❑ In this regard, the road infrastructures are considered as not favouring a balanced modal split. It is just a current trend in Spain more than a universal truth, because the railway, depending if it is high speed or conventional, can play a similar role as the roads in terms of impact on the system's inter-modality.
- ❑ This modal distribution of the investments in infrastructures is determined by the system's planning, as it sets the socio-economically reasonable limits of the investment, as well as its modal distribution. Likewise, planning diminishes the risk of duplication that affects to a balanced modal distribution.

⁵Currently the INSURE European project, in which the author of this article participates, and the objective of which is to create a generation methodology in order to develop systemic indicators of sustainable development, is progressing in the development of a methodology to produce systemic indicators from qualitative models such as the TEL system, which increases the potential of this approach. The INSURE project can be accessed from its Web page: www.insure-project.net.

- The transport services are a factor, which improves the environmental effects as they improve the modal distribution and the system's efficiency. The services are improved, through investments and R + D + i, and by the application of market instruments.
- The other important factor is the use of private vehicles. Investments on roads, the territorial inequities and the unequal distribution of infrastructures within the territory favour the use of private car, while the internalization of cost mechanisms and the improvement of public transport disfavours it.
- An unbalanced territorial distribution of infrastructures is responsible for land fragmentation and causes territorial destructurisation. This then generates effects on protected or valuable areas and on the biodiversity. The drive of an unbalanced territorial distribution is again the investment in roads, which also generated fragmentation. This influence can be counterbalanced creating hierarchical networks and hubs and having a territorial planning of the system.
- Public transport is, together with the system's aggregated efficiency and planning, one of the drives of the environmental compensation of the system. It affects the efficiency through the better modal distribution and it is favoured by explicit development policies, market instruments that make it more competitive and by investments on ports, railway and the creation of hierarchical networks and hubs of transports.
- Finally, the investments in Research, Development and Innovation (R + D + i) together with a direct environmental management are two tools with a positive influence on the system's effects on the environment. The direct management produces an immediate improvement. The R + D + i acts improving the services and more generally, increasing the system's efficiency.
- The inefficiency of the system is channelled through its congestion, and it is determined by the increase in the use of private vehicles and road transport in general. The saturation causes demand for new infrastructures and increases the future risk of externalities of the system.

Analytical Usefulness of the Sectorial Environmental System for the SEA

The sectorial environmental system that has been proposed here is an essential and integral part of an SEA in two ways:

- It constitutes the reference framework throughout the SEA, because it defines the environmental dimension of the PPP.
- It is the appropriate tool for environmental assessment of alternatives throughout the planning process phases.

The sectorial environmental system as an environmental reference framework for the decision-making process

The sectorial environmental system is the reference framework for the SEA, as it incorporates in an intelligible way those aspects which explain the **strategic environmental dimension** of the sectorial activity within a strategic decision.

This complex systemic pattern is not relevant to all sectorial decisions. In the context of transport sector PPP to design a new bus line, for example, it would be excessive to have a similar systemic context as this one depicted by the TET. Such a decision needs a framework adapted to its scope. So far the environmental sectorial system must fit the decision scope of the assessed decision.

A transport planning on a larger land scale must have a reference framework like the TET as a reference. The reference framework is essential in the case of large scale planning. It helps to identify decisive elements explaining the environmental profile of the sectorial activity. Furthermore, it helps the SEA process to identify leverage elements in the system, whose changes would suppose systemic improvements of the whole.

In order to act as a reference, the sectorial environmental system must be the framework for carrying out the environmental diagnostic of the sector addressed by the strategic decision. Its analytical use it allows identifying the underlying structure, which generates the current unwanted environmental perturbations. Therefore it allows the identification of needed structural changes and alternatives to make them feasible.

The sectorial environmental system in the environmental assessment of alternatives at various planning levels

First, the sectorial environmental system facilitates an environmental assessment of alternatives at the level of the objective setting as it allows a quick assessment if the PPP's objectives are targeted to solving the structural issues of the sectorial environmental system that were identified during the diagnostic phase.

Next, the sectorial environmental system provides the framework for assessing the available strategic options to implement de PPP objectives. Once the diagnosis has been made and the main causal chains, which account for the current state of the sectorial environmental system, have been identified, it is possible to assess to what extent each one of the strategic alternative options improves the state of things.

Then the sectorial environmental system also serves to assess the environmental effects of alternative options at the design stage. In that case, the system acts as a guide to assess the effects of these proposals, highlighting the causal chains, their final effects and the efficiency of the proposed measures in terms of the solution of the structural problems identified in the diagnostic.

Up to this point the assessments of alternative objectives or strategies are basically of a qualitative nature and tend to show that the plan is consistent with the scope of issues identified in the diagnostic. At the most lower detailed level of a plan or program, it makes sense to combine the use of the sectorial environmental system with quantitative assessment techniques and methods, even if they only address a limited number of the relationships identified.

For example, if the purpose is to assess the environmental benefits of the introduction of a new tariff, in the case of transport planning, the sectorial environmental system highlights the corresponding causal loop to be assessed. The data, which facilitates in part this assessment — the assessment of the specific effect of the new tariff on traffic flow — can be obtained using an economic-transport model. However, the effect on another causal line might be qualitatively evaluated. The most important aspect is that the sectorial environmental system highlights the systemic dimension of the evaluation subjects.

Challenges in Applying a Decision-Centred SEA

The innovative SEA model proposed in this article faces several challenges. A process-oriented assessment implies a completely different scenario than a product-oriented assessment, typically adopted in EIA practice. The most evident challenge is related to the fact that SEA is to be applied to a rather undefined assessment subject: the strategic decision processes that led to PPPs.

The practical consequence of this lack of definition (and standardization) is that the assessment does not interact with a linear logical process, or with a single agent of decision. The SEA process does not have a clear target from which to expect a consistent behaviour to ensure the incorporation of environmental value in the process. The SEA objectives, and target as well as its structure will depend heavily on the 'context-specific' nature of the decision process (cf. Audouin and Lochner, 2000; Bina, 2003).

Therefore, no universal pattern for the assessment practice exists. This complicates the evaluation of the success of the SEA procedure. There are no universal standards against which to measure the degree of incorporation of environmental value in the decision process.

All this requires a high degree of flexibility and adaptation capacity from the assessor, in order to identify, for each decision process, the margin within which actual progress can be made. Probably good SEA practitioners will require different expertise from those of EIA, individual skills such as knowledge on decision theory and planning methodologies and creative skills will play a bigger role.

Conclusions

As the relatively brief experience of the SEA shows, it will not be as easy as it was for EIA to establish a single definition and methodology, nearly universally valid, as working model. There are several reasons for this.

Having taken as an initial model the EIA of projects, it is an important obstacle to the better understanding of the nature and purpose of the SEA. This has slowed down the development of its own conceptual and operative framework (Bina, forthcoming).

However, the diverse and complex nature of the decision-making processes is also important. Even a precise conceptual definition of the SEA would face a decision related reality so diverse and complex that every experience will generate very different results in terms of form and content. This fact does not facilitate definitive conclusions about the definitive *raison d'être* of SEA (Kornov and Thissen, 2000).

Practical SEA experience is not sufficient in itself, unless we are provided by a conceptual framework that tells us which the specificity of SEA is. This article is a contribution towards finding a conceptual foundation for SEA. The conclusion is that SEA is about the incorporation of decision related environmental value in strategic decision-making.

It has been argued that it was necessary and possible to develop appropriate tools to achieve this new objective. The SEA methodology proposed makes possible the incorporation of the decision related environmental value in decision-making.

SEA methodologies cannot succeed if the specific strategic environmental dimension of PPP is not properly understood. The sectorial environmental system is the tool that enables the identification of this strategic environmental dimension. Improving decision-making through SEA means that the PPP addresses the structural problems faced by its sectorial environmental system. The SEA methodological steps proposed here are meant to ensure that this strategic environmental dimension is addressed during the decision-making process.

Any decision centred SEA is likely to be impregnated by certain rationalism, procedural at least. These are guided by the belief that it is possible to introduce increasing doses of rationality into the strategic decision-making processes. However, decision processes do not behave necessarily rationally, not even in terms of procedures. This makes every decision-process unique.

It is very probable that when trying to incorporate environmental decision related values in a given context, this context cannot assimilate them. However, the role of SEA is not to impose a specific set of decision related values to a specific decision related context.

SEA is an exogenous agent for any assessed PPP. SEA is itself a socially guided attempt to exogenously change the dominant decision related value in strategic

decision-making.⁶ A Certain level of conflict is to be expected. However, in this endeavour, the environmental decision related value SEA represents is just a starting point. The challenge for any SEA is to find out in practice the point at which it could really make a difference by including decision related environmental values in a specific decision-making process.

Models are useful in SEA, whether they refer to the definition of the purpose of the SEA, to its phases or its instruments. By standardizing the core elements of SEA they enable practitioners to define at the outset the way in which SEA can improve the decision. However, it is necessary to be willing, when moving to the practice of the SEA, to leave behind much of the ideas of what an SEA must be in order to grasp the real existing opportunity of taking a step forward in the improvement of the decision-making process at stake.

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⁶SEA has the specificity that changes the evaluandum during the evaluation. It introduces changes in decision-making just because of the fact that makes evident how the process takes place.

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