

Strategic Environmental Assessment by Multi-criteria Decision Making Techniques



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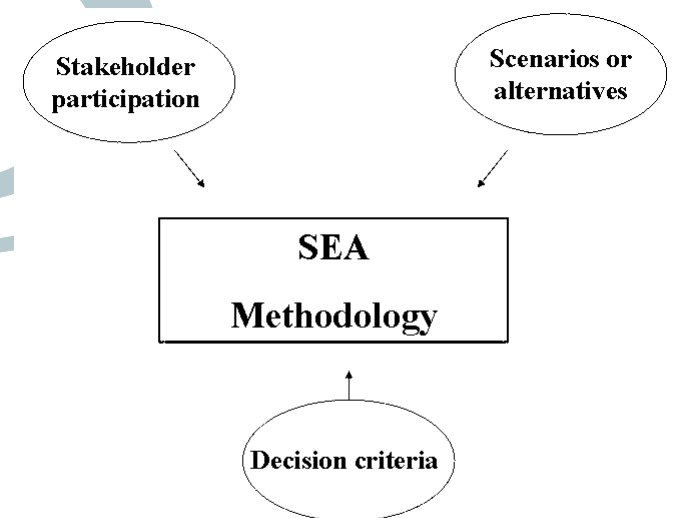
Assignment:

Development of the AHP method as a practical process tool to generate a strategic environmental assessment study, as a proper basis for sustainable development in the study area.

Technical Description:

Strategic Environmental Assessments (SEA) solve existing and/or future conflicts between socio-political, environmental and economic issues and provide a basis for sustainable development and an overall management plan with a special focus on the practical application towards this sustainability in full compliance with the natural resource developments. In many projects, an environmental impact assessment (EIA) is applied or even imposed. This is a powerful and commonly used instrument to (1) qualify and quantify the expected impacts of a well-defined future project on the environment, and (2) list possible and significant mitigation actions to minimise these expected impacts. In fact, in most cases one single project mostly attributes to a larger and more general tendency, development or goal in a more extended area. On a larger spatial and organisational scale, unfortunately the application of EIA is limited though and SEA brings a solution.

A SEA aims at selecting the best alternative of different possible scenarios, that balances the benefits of economics, environmental protection and social welfare while avoiding potential conflicts between the concerned stakeholders. The outcome does not replace the decision makers though, but helps and assists them in their final decision. The necessary input to perform a SEA is summarised in the figure below and depends on the characteristics of both the study area and the project.

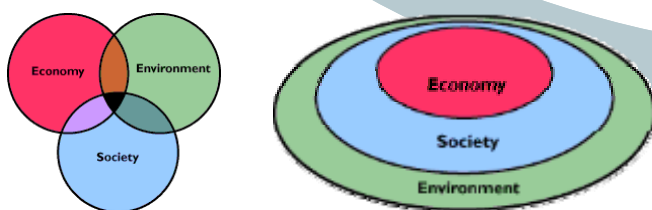


multi-criteria decision making technique:

Analytic Hierarchy Process (AHP) method (Saaty, 1987)

Necessary input for SEA

In a first step the actual societal, economical and environmental state of the defined study area is investigated together with the proposed development plans or the future goal. After this preliminary, but very important research, Multi-Criteria Decision Making (MCDM) techniques are applied. MCDM seeks to make explicitly the logical thought process that is implicitly carried out by an individual when coming to a decision. In general, MCDM identifies (1) the future goal and several alternatives or actions that can be investigated and decided upon, (2) a set of selection criteria by which to rank



A view of community as interacting circles

The realisation of a certain future goal in a defined area often leads to both conflicts between society, economy and environment and conflicts between the different stakeholders.



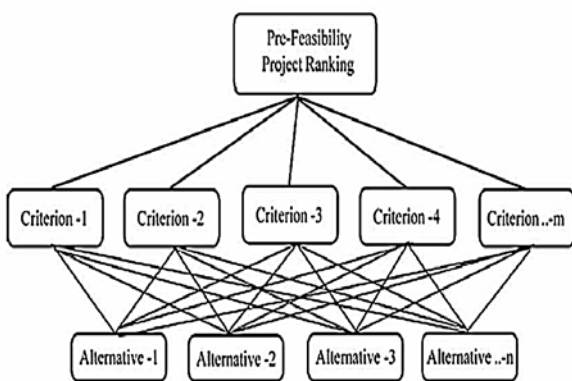
these alternatives, (3) a decision matrix which indicates the evaluated performance of alternatives in objective terms of respectively and (4) the method by which the alternatives are ranked and preferences are aggregated. Finally, a sensitivity analysis is carried out on the results in order to evaluate the reliability of the final alternatives' ranking.

One of the most widely used procedure is the Analytic Hierarchy Process (AHP) technique. An important characteristic of AHP is the performance of a questionnaire conducted amongst the relevant and concerned stakeholders. The questionnaire aims at a comparison of each criterion with another to calculate the weights of the determined criteria. Different stakeholder groups are accounted for to obtain objectively determined weights. The environmental pressures are linked to the other elements of the decision problem and arranged in a hierarchic structure. A complete set of pair-wise comparisons is elicited for the relative importance of the elements at each level of the hierarchy. The final outcome is thus based on the cumulative impacts and gives a preferred alternative or set of ranked alternatives being based on a definition of priorities by the stakeholders.

AHP has proven to be a useful methodology for the evaluation and prioritisation of options in numerous SEA projects, where there are many and possibly conflicting objectives and criteria that need to be balanced.

The advantages of AHP are related to the structure of the decision process which can be documented and replicated. It is applicable to decision situations involving multiple criteria as well as subjective judgements. Besides these advantages applying AHP in SEA allows the use of both qualitative and quantitative data and makes group participation possible.

This methodology of SEA has been applied with success on port development decision making problem in the South of Vietnam. The Ba Ria - Vung Tau province is characterised with large sea port developments but has also one of the largest divers and rich mangrove ecosystems. SEA made it possible to realise a reliable ranking of different sea port development alternatives with respect to sustainability which helps the decision makers to put their development plan into practise. It suggested the decision makers a phase-based execution of the existing master plan of the port developments.



An example of hierarchic structure of pressures



Sustainable port development in South Vietnam