

EASY-ECO ("Evaluation of Sustainability: European Conferences and Training Courses")

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# ASSESSING REGIONAL SUSTAINABLE DEVELOPMENTS

**KEY TOPIC** - Researchers as stakeholders: Developments in evaluation methodologies

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# Sustainable development

- Improving the quality of human life while living within the carrying capacity of supporting ecosystems
- Basic intentions of the sustainability concepts
  - It aims at directing decisions of policy bodies and private actors towards a joint state of the economy and the ecology, such that the needs of current and future generations are fulfilled without eroding the ecological basis for a proper welfare and activity level of these generations
- The normative nature of sustainability requires therefore a framework of analysis and of expert judgement which should be able to test *actual* and *future states* of the economy and the ecology against a set of reference values.

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# Sustainable development

- This requires three important components in any sustainability analysis for a region
  - identifying a set of measurable sustainability indicators
  - establishing a set of normative reference values (e.g., carrying capacity or critical load)
  - developing a practical impact methodology for assessing future developments (as a result of changes in behaviour, exogenous developments or policy orientations).
- A sustainable development in a given region or sector is not necessarily sustainable elsewhere
  - sustainability is context-specific and co-determined by needs and opportunities in a particular region or sector.
  - the analytical steps, indicators, reference values and impact analysis, will play a crucial role in any attempt at assessing the degree of sustainability (or at least its qualitative direction) in a relevant area .
- The purpose of my paper is to provide a systematic overview of the main issues and problems related to evaluation in general, and for regional development programmes in particular.

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# Requirements of the environmental state evaluation

- Stochastic method – classical approach
  - It aims at the repeated survey and recording of elements of the environment.
  - A major disadvantage of this method is that there is no way to identify the causes responsible for the changes so it is not or to a very limited extent is suitable for making environmental prognoses.
- Deterministic method
  - This can be eliminated by exploring the external effects, the paths and effects of polluting materials, noise and radiation in the environment.
  - The method, however, is still analytical, only one factor can be observed at a time and this is not sufficient to describe the real changes in the state of the system.
- Holistic method
  - This assessment examines the interference of various activities, measures as well as the systems consisting of one or all environmental media.

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# Requirements of the environmental state evaluation

- The applicability of these aspects in the Environmental State Appraisal (ESA) provide the solution of three further tasks:
  1. a set of parameters suitable for classification of the changes according to the given aspects can be specified (and the actual values of these parameters can always be obtained);
  2. secondly, a value-scale has to be constructed for the chosen parameters so that the environmental state can not only be described but also evaluated;
  3. thirdly, evaluation algorithms are to be implemented, which can carry out a reconstructable and objective evaluation. (Bulla, Széchi, 2003)

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# The importance of evaluation methods for sustainable development planning

- The sustainability of any region is relative to external factors
- As the theme of sustainability is intrinsically multidisciplinary and multisectoral, this suggests that effective appraisals should likewise be based on a holistic or integrated assessment.
- A regional scale of analysis is desirable for the following reasons:
  - environmental decision-making can be more easily guided by a regional governmental agency;
  - interactions and feedback mechanism are more easily traceable at a regional than a national level,
  - regions have specific problems or capacities that should be dealt within their right context and level of detail.
- Evaluation aims at rationalising planning and decision problems by systematically structuring all relevant aspects of policy choices.
  - monetary and
  - non-monetary evaluation.

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# The purpose of evaluation

- The improvement in the state of the environment is not equal with sustainability → the counter-process indicates the failure in the realisation of sustainability.
- *Evaluation*
  - is a process which seeks to determine as systematically and objectively as possible the relevance, efficiency and effect of an activity in terms of its objectives.
  - it represents the assessment of the outputs, outcomes and processes of an activity.

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# Tools of evaluation

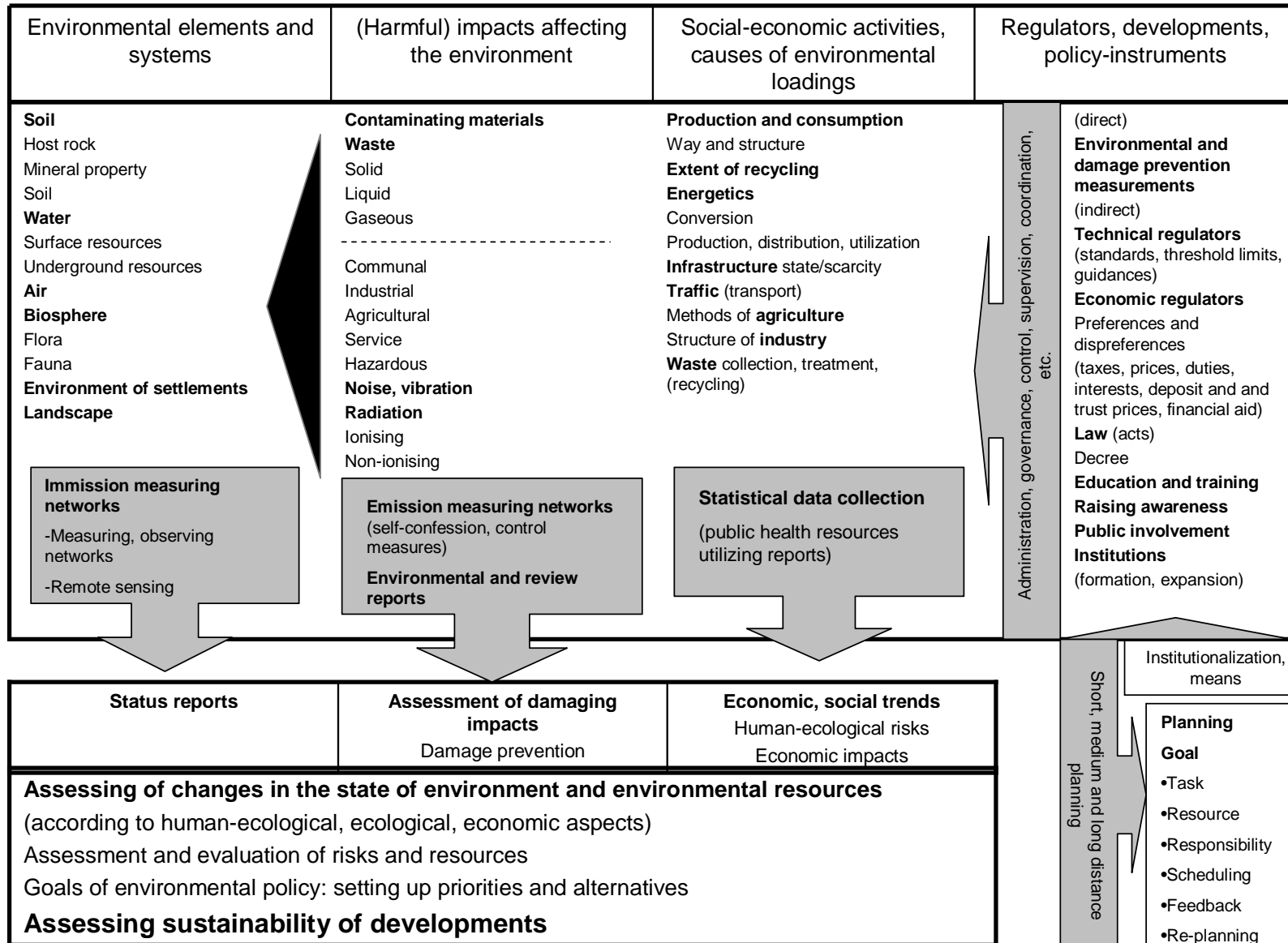
- The analytical framework from which they emerged and within which they mostly operate;
- Their suitability for policy, programme or project evaluation;
- Their suitability for different phases of policy analysis (i.e. ex-ante, monitoring or ex-post);
- The extent they rely on statistical or mathematical methods or tools or alternatively on 'softer' methods.

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# Environmental State Appraisal (ESA)

- It is necessary to have information that
  - provide the actual state of the environment,
  - explore the casual connections,
  - indicate the probable trends of the changes
- With the help of ESA expert system the changes in the state of the environment as well as the effects of the rational prevention can be modelled → this way the environmental effects can be forecasted, the necessary actions and their expectable costs can be calculated.
- The model of environmental management does not include the natural interactions.
- But it is suitable to define these
  - working out environmental protection programmes,
  - achieving them,
  - supervising them,
  - summarizing the results, indicating new aims, priorities and tasks.

# Environmental State Appraisal (ESA)



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# Strategic Environmental Assessment (SEA)

- SEA is a new framework analysis tool for assessing various networks and large scale projects – it mainly refers to the environmental assessment of programmes and policies.
- The scope of SEA and the degree of detail of the assessment largely depend on the level of planning – environmental, socio-economic, etc. objectives by which the strategic action is led.
- It also helps in estimating more local characteristics of the environment-noise, visual impact etc. as opposed to other form of evaluations.
- This method can be most commonly used for evaluation policies.
- The advantages of SEA are
  - Environmental issues are given greater degree of influence of general policy formulation.
  - It encourages consideration of alternatives which might be ignored otherwise.
  - It allows effective analysis of cumulative effects of projects.
  - It facilitates both planning and analysis of synergistic effects.
  - It is capable of taking delayed impacts into account.
  - It can enhance both communication between responsible and the involvement of the public.

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# Multi-Criteria Analysis (MCA)

- Multicriteria methods are an appropriate modelling tool for combined economic-environmental evaluation issues.
- In an environmental planning process it is very difficult to arrive at straightforward and unambiguous solutions → such a multi-related planning process will always be characterised by the search for acceptable compromise solutions → multiple criteria evaluation techniques aim at providing such set of tools.
- Multicriteria methods provide a flexible way of dealing with qualitative multidimensional environmental effects of decisions.
- The main advantage of these models
  - is that they make it possible to consider a large number of data, relations and objectives which are generally present in a specific real-world decision problem, so that the decision problem at hand can be studied from multiple angles.
- The main disadvantage of a multicriteria model
  - is that an action a may be better than an action b according to one criterion and worse according to another. Thus when different conflicting evaluation criteria are taken into consideration, a multicriteria problem is mathematically ill-defined. The consequence is that a complete axiomatization of multicriteria decision theory is quite difficult.

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# The GIS system

- On the one hand, most of the environmental problems have spatial dimensions. These environmental problems can be better understood through environmental modelling and it is easier to find the solution.
- On the other hand, the geographic information systems are able to collect, integrate, manage and analyse the spatial data with geo-reference. Such a system as general-purpose technology is able to handle the data in digital form.
- A global decision support system should provide the widest possible range of model parameters, but it should also emphasize the factors of significant influence, and calculate the values mostly contributing to the state of environment at the same time. However, this requires the costly collection of adequate data and tools able to do the calculations. The models themselves also require their own structures, as input and output tables, maps and model conditions are to be specified for every state of environment. The user may launch the calculations directly, or through higher level models.

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# Fuzzy Analysis

- Attempting to model the sustainable development of a region, a methodology for the characterization and management of data is necessary to provide more information and is vital for improved decision-making abilities.
- The fuzzy method uses fuzzy logic reasoning and basic indicators of environmental integrity, economic efficiency, and social welfare to quantify measures of sustainability at the local, regional, or national levels, along with the sensitivity analysis of the fuzzy method.
- This approach can be implemented to appropriately handle the aforementioned data uncertainties and provide a sound basis for rigorous sustainability decisions to be made.
- Sensitivity analysis is critical to successful decision-making abilities since it studies the dependency of regional sustainability indicators on various policies and regional decisions.

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## Concluding remarks

- It would be desirable to construct a comprehensive impact model which would encapsulate the complex interacting patterns of regional development and related land use in relation to social and environmental variables → such a modelling activity could take the form of either an econometric model or a simulation model.
- Future intentions
  - To establish and develop such modern expert system based on mathematics that is suitable to evaluate the state of the environment, in a wider sense to analyse the relationships of changes of state as consequences of impacts on the environment
  - With the help of it the changes of state depending on the changes of environmental loadings can be forecast, the environmental and impact assessments can be expanded and further developed.