Development and Comparison of Sustainability Indicators

POLICY BRIEF
Analytical frameworks

The scientific literature dealing with assessments/analyses of sustainability includes different typologies of quantitative frameworks and evaluation procedures (DPSIR, PSR, STEEPV, MIPS, MUSIASEM, ASA, SUMMA among others). An analysis of the strength and weakness of the different tools requires the development of a taxonomy, in order to categorize the various approaches in relation to: (i) their objectives; and (ii) their ability of delivering results in relation to these objectives.

There are analytical frameworks that focus on the appropriate definition of the issue of sustainability – for example the DPSIR approach – in terms of a choice of relevant aspects to be considered in the analysis. These frameworks look for an effective procedure to be used to identify WHAT is relevant in relation to sustainability issues in order to focus on a set of "relevant attributes" of sustainability. Then these "relevant attributes" can be quantified by selecting an appropriate set of proxy variables.

There are other analytical frameworks, for example MIPS, that already assume the identification of a relevant attribute of sustainability – in this case the material intensity of a service delivered to the economy – and focuses on HOW ad HOW MUCH the specific attribute is different when considering different situations or processes.

When dealing with analytical frameworks proposed for generating WHAT indicators, it is the ability of selecting the right choice of semantic categories that matters; when dealing with analytical framework generating HOW indicators, it is the ability of selecting the right choice of data and protocols – in relation to the issue to be dealt with - that matters.

At this point it is possible, when classifying analytical methods, to make a distinction between:

A. methods that explicitly address the need for performing a quality check on the validity of both:

(1) **the semantic choices** behind the issue definition used for quantification - e.g. Is the criterion/ attribute to which an individual indicator refers to a valid one? Is the choice of the given set of relevant attributes (criteria) used to characterize the sustainability of a system relevant?

(2) **the syntactic choices** behind the selection of a lexicon and production rules used in the quantification - e.g. is the chosen protocol pertinent? Are the chosen proxy variables reflecting the semantic associated with the chosen attributes? Do we have access to reliable data if we decide to use this indicator?

B. methods that focus only on the specification and implementation of a given protocol. These methods assume that the quality control on both the semantic and the applicability of the relative protocol to the particular issue to be dealt with, is given by default.

From the discussion of the different analytical frameworks it is clear that there is no single analytical framework which can deliver the perfect combination of "focus" (issue definition) and "indicators" (relevant data). For this reason, we claim that it is necessary to combine different analytical frameworks to achieve an integration between:

(i) qualitative and quantitative analyses;

(ii) different types of quantitative analysis referring to different disciplinary dimensions (e.g. economic, demography, ecology, thermodynamic);

(iii) different types of perceptions and representations of the investigate system referring to different levels and scales (e.g. individual, household, town, regions, country, the planet).

Recommendations on relevant steps for integrated assessment

All frameworks investigated share common features to be highlighted and limits to be overcome. An integration procedure needs to identify crucial steps that are mandatory for the reliability of the results and factors that may enhance or decrease their applicability to a real case or to a larger number of cases. Some steps are more qualitative, others are mainly based on quantitative data. In all, both aspects must be taken into proper account, provided that the procedure is based on an agreed upon identification of the problems and the goal, a shared awareness of uncertainties that may affect the results as well as of the meaning of calculated indicators, and finally a joint discussion of the results and their applicability.
The following are the most relevant issues that need to be dealt with for an integrated assessment toolkit:

- Identification of the problems by the analyst or policy maker;
- Identification and gathering of social actors affected/affecting the process under analysis (institutional analysis);
- Understanding the perception of the problems by stake-holders (participatory process);
- Checking the congruence between the perception of relevance proposed by the analyst or policy maker with the perception of relevance proposed by the stake-holders;
- After agreeing with a semantic definition of what the system is and what the system does (in relation to the goal of the analysis), identification of the system, drawing a systems diagram by individuating relevant components, levels, key interactions, input and output flows;
- Development of a grammar capable of handling the existence of different hierarchical levels of organization across scales (the existence of non-equivalent descriptive domains) in order to build bridges across dimensions and levels;
- Collection of data (units, quality, uncertainty, references);
- Classification of data (sectors, levels, categories, attributes);
- Organizing raw data (tables, diagram);
- Processing of data and calculations of indicators (all levels, sectors, categories, attributes);
- Monitoring changes of intensity factors over time (technical, economic and social);
- Quality control (sensitivity analysis: influence of data errors; participatory integrated assessment: uncertainty and misunderstandings of problems perception);
- Influence of presence or lack of feedbacks across scales;
- Discussion of results (meaning of indicators) versus attributes, perceptions, goals;
- Policy Issues: Constraints, inter-linkages, impacts, alternatives, sustainability.

The use of analytical integrated frameworks by different social actors and stakeholders assigns very different importance and priorities to the various aspects of a process. There is no way nor need to prevent or dismiss the existence of these different perspectives and legitimate interests. It is therefore of paramount importance not to assign an absolute meaning to any of the numerical results that are generated within any given evaluation procedure applied to a given issue definition and the resulting quantification (problem structuring). The analysts can not and should not just focus on those aspects that he/she considers the most important (e.g., the CO2 emission contributing to the global warming), because in so doing it would ignore different perceptions of priorities, inducing a loss of legitimacy in the credibility of the quantitative analysis and a consequent lack of involvement for the majority of the other stakeholders. The analyst should also always keep in mind the existence of important ethical issues entailed by the fact that many social actors cannot represent themselves in the assessment (other species, marginal groups, ethnic minorities, future generations) as well as the existence of common goods and resources that can be used but should not be converted into private property (clean air, fresh water, healthy oceans, biodiversity, etc). Such an awareness requires the inclusion in the assessment of analytical tools (e.g. Emergy analysis), that also take into account the environmental support and services provided for free by nature and the importance of which is most often disregarded.

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