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Julien-François Gerber (REEDS-UVSQ)

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Beatriz Rodríguez-Labajos (ICTA-UAB), Ivonne Yánez (Acción Ecológica), Virgínia Branco, Philippe Roman, Liz Rosales and Pierre Johnson (REEDS-UVSQ)

Design:

Jacques bureau for graphic design (Netherlands)

Layout:

Cem İskender Aydın

Series editor:

Beatriz Rodríguez-Labajos

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Abstract

This introduction to multicriteria evaluation methods for Environmental Justice Organizations (EJOs) intends to help activists to clarify whether multicriteria assessments can be useful in their struggles – that is, as carried out by themselves or as something that has to be done by an appropriate body. In the present guide, we review three MCEs that are arguably today the most relevant for EJOs.

These particular MCE methods have been chosen because they are widely recognized, participative, and doable with relatively limited means. They are: Social Multicriteria Evaluation (SMCE), Multicriteria Mapping (MCM), and the Integraal framework. While only one aims at calculating a ranking of the different options – the SMCE –, the other two provide a way of comparing and analysing the different positions involved in a multicriteria problem and may (or may not) end up with a clear final ranking. The three methods build on a number of common principles: they all (1) have a strong element of public and/or stakeholder engagement; (2) account for different types of knowledge (monetary and non-monetary; quantitative and qualitative data); and (3) provide opportunities for learning during the appraisal process. After a description of these three different MCE methods, the guide takes the 'leaving oil in the soil' campaigns, with special emphasis on Ecuador and Nigeria, as possible examples for future MCEs.

Keywords

Multicriteria evaluation

Social Multicriteria Evaluation

Multicriteria Mapping

Integraal

'Leave oil in the soil' campaigns

Nigeria

Yasuní ITT proposal

Pluralism of values

Contents

Acronyms

AHP	Analytic Hierarchy Process
ASPID	Analysis and Synthesis of Parameters under Information Deficiency
CBA	Cost/Benefit Analysis
CDM	Clean Development Mechanisms
CSO	Civil Society Organisations
DEFINITE	Decisions on a Finite set of Alternatives
EJOs	Environmental Justice Organisations
ELECTRE	*Elimination Et Choix Traduisant la Realité* (Elimination And Choice Expressing Reality)
GDP	Gross Domestic Product
kerDST	Kerbabel Decision Support Tool
MAUT	Multi-Attribute Utility Theory
MCA	Multicriteria Assessment
MCDA	Multicriteria Decision Aid
MCDM	Multicriteria Decision Making
MCE	Multicriteria Evaluation
MCM	Multicriteria Mapping
NAIADE	Novel Approach to Imprecise Assessment and Decision Environments
PROMETHEE	Preference Ranking Organisation Method for Enrichment Evaluations
PMCE	Participatory Multicriteria Evaluation
REDD	Reduced Emissions from Deforestation and Forest Degradation
SMCE	Social Multicriteria Evaluation

Foreword

Conflicts over resource extraction or waste disposal increase in number as the world economy uses more materials and energy. Civil society organisations (CSOs) active in Environmental Justice issues focus on the link between the need for environmental security and the defence of basic human rights.

The EJOLT project (*Environmental Justice Organizations, Liabilities and Trade*, www.ejolt.org) is an FP7 Science in Society project that runs from 2011 to 2015. EJOLT brings together a consortium of 23 academic and civil society organisations across a range of fields to promote collaboration and mutual learning among stakeholders who research or use Sustainability Sciences, particularly on aspects of Ecological Distribution. One main goal is to empower environmental justice organisations (EJOs), and the communities they support that receive an unfair share of environmental burdens to defend or reclaim their rights. This will be done through a process of two-way knowledge transfer, encouraging participatory action research and the transfer of methodologies with which EJOs, communities and citizen movements can monitor and describe the state of their environment, and document its degradation, learning from other experiences and from academic research how to argue in order to avoid the growth of environmental liabilities or ecological debts. Thus EJOLT will increase EJOs' capacity in using scientific concepts and methods for the quantification of environmental and health impacts, increasing their knowledge of environmental risks and of legal mechanisms of redress. On the other hand, EJOLT will greatly enrich research in the Sustainability Sciences through mobilising the accumulated 'activist knowledge' of the EJOs and making it available to the sustainability research community. Finally, EJOLT will help translate the findings of this mutual learning process into the policy arena, supporting the further development of evidence-based decision making and broadening its information base. We focus on the use of concepts such as ecological debt, environmental liabilities and ecologically unequal exchange, in science and in environmental activism and policy-making.

The overall **aim** of EJOLT is to improve policy responses to and support collaborative research on environmental conflicts through capacity building of environmental justice groups and multi-stakeholder problem solving. A key aspect is to show the links between increased metabolism of the economy (in terms of energy and materials), and resource extraction and waste disposal conflicts so as to answer the driving questions:

Which are the causes of increasing ecological distribution conflicts at different scales, and how to turn such conflicts into forces for environmental sustainability?

Environmental activists usually face multifaceted political situations involving different interest groups. In particular, activists typically have to confront the government and/or the business sector – usually the most powerful stakeholders – as well as the very specific technical tools that they use in order to prove the righteousness of a given project. So far Cost/Benefit Analysis (CBA) is perhaps the most employed approach to argue whether a particular project is socially desirable or to compare alternative projects to develop in an area. CBA entails the aggregation of all the expected costs along the duration of a project and its comparison with all the expected benefits, also aggregated (OECD, 2006). Under certain conditions, such an approach can work very well. However, the aggregation process precludes the monetary valuation of all kind of expected effects, that is, they all should be *commensurable* in money terms. Land rights, human life, aesthetics, cultural significance, sacredness/spirituality, historical meaning, biodiversity, etc. are just a few examples of relevant values that cannot easily be quantified monetarily. There is often an *incommensurability of values* that has to be recognised as a starting point.

How to deal with different value systems when facing a real problem of social choice? Fortunately, there is a whole orchestra of instruments besides CBA that can be used in support of social deliberation and social decision-making. Among them, environmental activists may use or demand *Multicriteria Assessments* (MCAs) in their campaigns. This introduction to multicriteria evaluation for Environmental Justice Organisations (EJOs) intends to help activists to clarify whether MCAs can be useful in their struggles – as carried out by themselves or as something that has to be done by an appropriate body.

1 Introduction

1.1 What is a multicriteria assessment?

MCAs encompass a whole family of decision-making approaches used to evaluate problems with different alternatives, expectations and wants, in order to find the most 'suitable' solutions. MCAs deal with complex and unstructured problems form decision making, mainly in the sphere of socio-environmental management and involving a number of conflicting ecological, social, political and economic objectives, multiple interests groups, and different languages of valuation. They are typically dealing with the incommensurable, uncertain and irreversible effects of the decisions to be taken.

MCAs constitute a framework for structuring decision problems as well as a set of methods to generate preferences among alternatives. A multicriteria problem is characterised by the presence of (1) a finite set of alternatives (e.g. alternative corridors for a railway or different design options for a regional transportation system) and (2) the existence of different – and often conflicting – valuation criteria under which we evaluate each alternative (e.g. impacts on land use, travel costs, people affected). Those criteria often relate to different perspectives, and languages of valuation. The subjective dimension of MCAs remains therefore central but can be tackled though participation and appropriate indicators (see **Box 1**).

MCAs constitute a framework for structuring decision problems, typically dealing with the incommensurable, uncertain and irreversible effects of the decisions to be taken

MCAs include a wide variety of approaches and methods, depending on assumptions and criteria (e.g. level of participation, degree of formalisation, etc.). The common ground aims at conducting assessments that take into account different evaluation criteria. There is a gradation between the most 'closed' (unparticipatory) MCAs – referred to as Multicriteria Analyses and involving experts only – to the most 'open' (democratic) one, referred to as Deliberation, such as citizen juries or panels, consensus conferences or community assemblies. In the present Guide, we only take into account the middle ground between these two poles: Multicriteria Evaluation methods (MCEs), which contain a stronger element of analysis and a more structured approach than pure Deliberations. These broad categories of MCAs are summarised in **Table 1**.

Framework		Objective	Participation	Examples of method	References
Multicriteria analyses	Multicriteria decision making (MCDM)	To elicit clear preferences from a ('mythical') decision-maker and then to solve a well-structured problem by means of mathematical processes	Little or none (experts)	Weighted summation; AHP; ASPID	Zionts (1979); Zionts and Wallenius (1976)
	Multicriteria decision aid (MCDA)	To enhance the quality of the decision-making process through iterative operations and the 'constructive' or 'creative' approach	Typically restricted to experts	ELECTRE; PROMETHEE; REGIME	Roy (1985)
Multicriteria evaluation	Participatory multicriteria evaluation (PMCE); social multicriteria evaluation (SMCE)	To produce, in a participatory way, an analysis which takes into account different evaluation criteria and different perspectives and choices from stakeholders	Stakeholders	REGIME; NAIADE	Banville et al. (1998); Proctor and Drechsler (2006); Munda (2005; 2008)
	Multicriteria deliberation	The above + seeking a process of collective intelligence	Open to all stakeholders	Multicriteria mapping; Integraal	Stirling (1997); O'Connor (2007)
Deliberation		To take multicriteria decisions democratically (e.g. by voting)	Open to the public	Citizen jury; village assembly	

Table 1. Multicriteria Assessment (MCA) frameworks

Source: own elaboration based on Garmendia and Gamboa (2012) and on the cited references

The literature offers a comprehensive survey of MCA methods (Figueira et al., 2005), some of them focussing on their sustainability implementations (De Montis et al., 2004). Methodological work in this field focused on discrete methods[1] has been done by Saaty (1980) who developed the Analytic Hierarchy Process (AHP); Roy (1985; 1991; Roy and Vincke, 1981) who pioneered the multicriteria assessment with the ELECTRE family of methods; Brans (Brans et al., 1986) who created the PROMETHEE method; Hinloopen and Nijkamp (1990) who developed the REGIME method; Hovanov et al. (2006) who designed the randomised preference based method called ASPID; and Munda (1995; 2005) who developed the NAIADE method. An example combining different approaches is the DEFINITE package, developed by Janssen (1993) . See also **Boxes 1** and **2**.

[1] Multicriteria methods can be classified as either discrete or continuous, depending on the nature of alternatives. *Discrete* alternatives are limited in number, usually pre-specified by the analyst or by stakeholders (for example, selected places for the location of a facility). *Continuous* alternatives involve a large, even infinite number of options, and often are described though mathematical models (for instance, all possible time moments within a specified period).

[2] The acronyms are explained in page 4 and selected methods are described in **Box 3**.

Some MCEs as well as most Multicriteria Analyses entail sophisticated toolboxes (typically software) that guide the analyst in the selection and implementation of the different steps along the evaluation methods (see also **Box 2**). Alternatively, more participatory MCEs usually rely on less formalised tools. Though participation and mathematics are not by principle opposed, they are usually seldom found together. In the present guide, we emphasised less formalised and more participative MCE techniques.

Box 1 The aggregation procedure and the notion of compensation

Talking about sustainability, the notion of compensation is crucial. It refers to the issue of trade-offs between criteria, i.e. to what extent it is acceptable that the advantages of one attribute can be traded for disadvantages of another. In fact, MCA software packages (see Box 3) can be classified into three major groups according to the degree of accepted compensation, which is revealed through the aggregation procedure within each approach.

- **Lexicographic model** – Alternatives are compared through a set of attributes, examined in order of importance. The first criterion to take into account is the 'dictator', the most important one. If alternatives are equal according to it, the analysis moves to the next more important, and thus successively. There is no aggregation in this approach, which forbids trade-offs. The relevance of the criteria depends then on the order in which they are taken into account, so this is clearly a non-compensatory method. In practical terms, this situation can be found whenever there is an agreement that one particular aspect (e.g. environmental protection or human rights) must be above the others when the decision is taken. Sadly enough, there is also a lexicographic praxis of using economic benefits as the dictator criterion to compare alternative projects.
- **Multi-Attribute Utility Theory (MAUT)** – Under this approach, any decision problem can be solved through the specification of a value function that aggregates the score of all the criteria in the same value unit. The multicriteria problem is transformed into a mono-criterion problem: maximise the value of the function. This can be done, for instance, though a weighted summation, although the establishment of criteria weights is one of the common challenges of multicriteria algorithms (Choo et al., 1999). In any case, this kind of aggregation procedure admits that the bad performance in a given criterion (e.g. biodiversity loss) is compensated by the good performance in another (e.g. employment creation). This is then a fully compensatory method, which shows that all possible alternatives are comparable with each other, and it is possible to determine one single ranking.
- **Outranking methods** – Pairwise comparisons between alternatives, according to the difference between their criteria scores allow one to determine preferred relationships for each criterion. Then, based on pre-established rules of aggregation, it is possible to elicit the global relationships between alternatives, namely preference, indifference or incomparability. Outranking methods claim to be only partially (or minimally) compensatory.

In the present guide, only outranking methods are taken into account, e.g. in NAIADE below. See also Bouyssou (1986).

Several examples of MCE applications exist for regional problems, e.g. industrial development (Nijkamp and Delft, 1977), waste management (Shmelev and Powell, 2006) or renewable energy (Madlener and Stagl, 2005; Gamboa and Munda, 2007). An application of a non-compensatory multicriteria approach is the Environmental Sustainability Index (Yale Center for Environmental Law and Policy, 2005) where, however, dynamic aspects were not addressed. There are also theoretical contributions for studying the multi-dimensional dynamic patterns of development with the help of multicriteria methods (Omann, 2000). However, empirical attempts are rare (Falconí, 2002; Shmelev and Rodriguez-Labajos, 2009).

1.2 In this guide

In the present Guide, we review three MCEs that are arguably the most relevant for EJOs because they are widely recognised, participative, and doable with relatively limited means. They are: Social Multicriteria Evaluation (SMCE), Multicriteria Mapping (MCM), and the Integraal framework. While only one aims at calculating a ranking of the different options – the SMCE –, the other two provide a way of comparing and analysing the different positions involved in a multicriteria problem and may (or may not) end up with a clear final ranking. The three methods build on a number of common principles. They all:

- have a strong element of public and/or stakeholder engagement;
- account for different types of knowledge (monetary and non-monetary; quantitative and qualitative data);
- provide opportunities for learning during the appraisal process; and
- ensure transparency of each step of the appraisal process.

After a brief description of these three different MCE methods, we shall take a concrete case, namely the 'leaving oil in the soil' campaigns in Ecuador and Nigeria.

2 Three main types of multicriteria approaches for EJOs

2.1 Social multicriteria evaluation

2.1.1 Description

SMCE:
A tool to integrate different scientific languages in a public choice framework, when civil society and ethical concerns about future generations have to be considered, along with policy alternatives and market conditions
G. Munda

Giuseppe Munda (1995; 2008) has suggested an approach to multicriteria evaluation that he calls 'social multicriteria evaluation' (SMCE). Munda defines SMCE as a "tool to integrate different scientific languages in a public choice framework, when 'civil society' and ethical concerns about future generations have to be considered, along with policy alternatives and market conditions". SMCE aims to foster transparency, reflection and learning in decision processes, simultaneously integrating political, socio-economic, as well as ecological, cultural and technological dimensions of the problem. As various dimensions are taken into account, the main goal is to find a balance between them, aiming at 'compromise solution' (Munda, 1995).

SMCE is perhaps the most well-known framework available and has been used successfully in a number of empirical contexts. EJOs may find it very useful. But because the associated software (like NAIADE) takes a central position in the process, some time and energy will be required to understand it.

2.1.2 Framing [3]

Consider for example a proposal to build a new road through a wilderness area, which would destroy the habitat of a number of rare or threatened species. The team of researchers (or activists or other stakeholders) starts by conducting an

[3] The following subsections on SMCE are adapted from Stagl (2007).

institutional analysis and possibly a historical trend analysis in order (a) to understand the ecosystem of the wilderness area and the socio-economic context of the road construction and (b) to develop policy options and appraisal criteria. For this purpose, they use information from secondary data, focus groups and interviews with stakeholders and citizens. Then the impacts of the policy options are modelled by researchers from relevant disciplines and the results are collected in an impact matrix. The impacts can be measured in quantitative or qualitative terms. This stage is supported by expert discussion groups and interviews. Finally, a ranking of policy options is calculated and presented to stakeholders. Stakeholders are encouraged to interrogate the data, weightings of criteria and resulting rankings. The iterative process can lead to social learning among stakeholders.

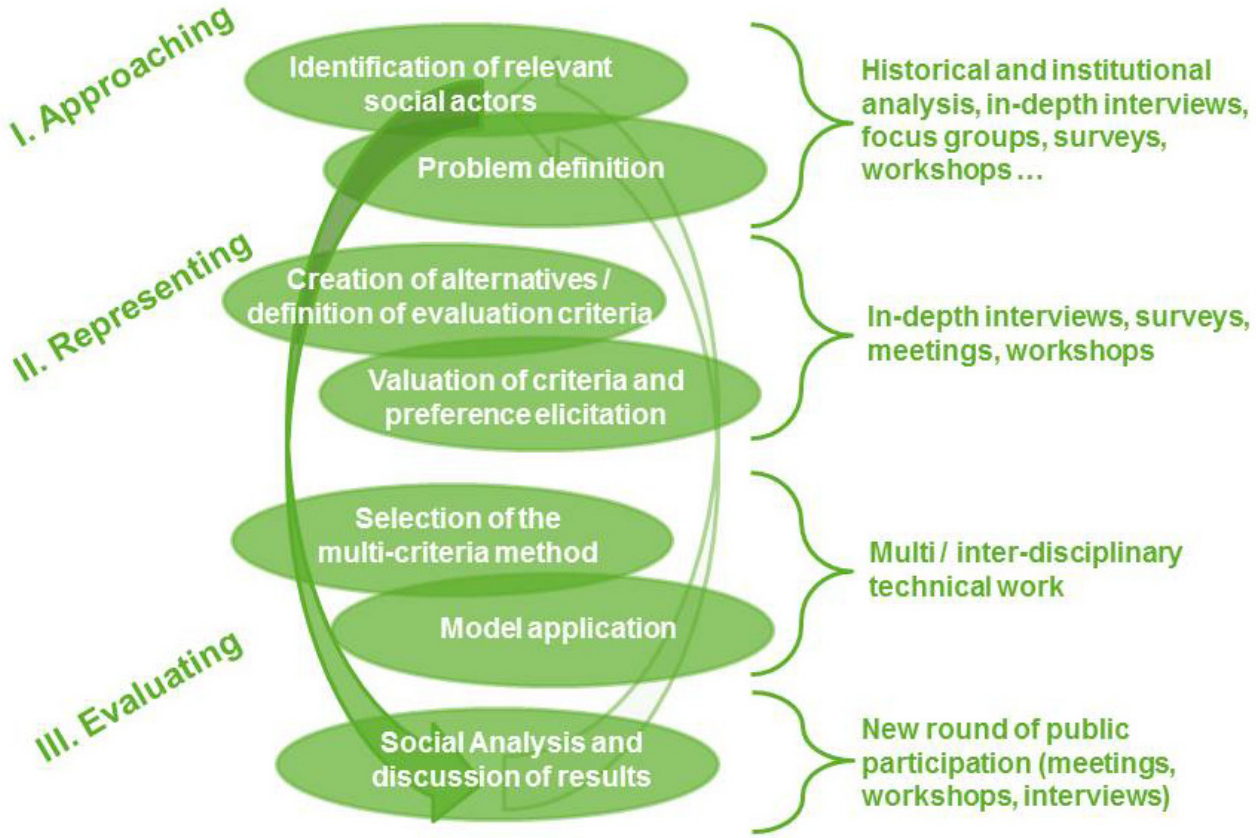

Fig. 1

Framework of a SMCE

Source: Garmendia *et al.* (2010)

SMCE starts from understanding the decision-making context, the range of relevant alternative ways to achieve a particular policy aim (options or scenarios) and the set of criteria to represent different viewpoints

The structure of a SMCE consists of six main steps represented in **Fig. 1**:

1. Understanding the decision-making context and the need for stakeholder and public participation covering the main option as well as ensuring 'buy-in' from relevant groups of society (e.g. through institutional analyses); based on that, one can characterise a comprehensive range of relevant alternative ways to achieve a particular policy aim (options or scenarios)
2. Developing a set of criteria to represent different viewpoints on the issues that are relevant to the appraising of those options
3. Evaluating options/scenarios against each criterion based on models or expert judgement from various disciplines ('impact matrix') and specifying the preference function for each criterion
4. Assigning a quantitative 'weighting' to each criterion, in order to reflect its relative importance under the viewpoint in question (this does not apply to NAIADE though!)
5. Calculating an overall performance rank for each option/scenario under all the criteria; this can be presented either as an overall ranking based on group weights or separate rankings for particular viewpoints or individuals
6. Analyzing the potential for conflicts and coalitions between participating stakeholders ('equity matrix'[4]).

Participation and deliberation among citizens or stakeholders over alternative scenarios has the potential to make the evaluation more real. The iterative process of SMCE is flexible and allows for new options to be added as the social learning process proceeds. Incommensurability does not imply incomparability. The method allows that different options are weakly comparable, that is comparable without recourse to a single type of value. Multicriteria analysis does, however, require a clear distinction between options and criteria and the criteria should be independent of each other.

[4] The equity matrix uses information from the preferences of different respondents; it helps to analyse the position of different stakeholders and the potential formation of coalitions among the actors to defend or veto a policy option (representation in a dendrogram of coalitions). Intra- or intergenerational equity can also be included as a separate criterion making the impacts of policy options among one generation or on other generations more explicit and offering the opportunity to give more importance to this dimension.

Box 2 The key components of a multicriteria problem

A multicriteria problem definition entails the specification of the following elements:

Objective – The socially desirable purpose that has to be achieved. Defining the objective is not easy whenever there is a fundamental conflict between objectives among stakeholders. Sometimes, the objective may differ according to the scale of analysis. The objective is rightly specified when all the participants provide the same answer to the question: *What do we want to achieve?*

Alternatives or options or scenarios – Decision makers may choose within a set of optional ways to reach the objective. Typically, each alternative has different consequences in terms of the relevant criteria. For this reason, stakeholders perceive alternatives differently. Identifying alternatives means to collect all relevant answers to the question: *How do we want to achieve the objective?*

Criterion – A relevant property of the system that is used as the practical base for comparing alternatives. Groups of criteria are sometimes referred to as 'dimensions' (e.g. environmental, social, economic, etc.). The performance of each criterion can be judged according to diverse indicators that enable the criteria score. For instance, employment can be a social concern, and hence a criterion, which can be expressed through different indicators (e.g. employment rate, as a percentage of total labour force, youth unemployment rate, full- or part-time status, etc.). Identifying criteria means to ensure a comprehensive answer to the question: *Which are the relevant aspects to compare alternatives?*

Indicators – a unit of information used to show how criteria may change among the different alternatives. Indicators must be indicative, sensitive to differences in conditions, and broadly acknowledged (e.g. scientifically). Indicator can be (1) nominal (yes or no – presence or absence of a given criteria); (2) ordinal (1 to 5, 1 to 10, etc. or: first, second, third, etc.); or (3) cardinal (quantitative information, measure). Indicator answer to the question: *How do criteria vary among alternatives?*

Impact matrix – A formalised summary of the above, in matrix format. For example:

Criteria / Criteria score		Alternative a_1	Alternative a_2	Alterative a_3
Criteria X	Indicator x_1 … Indicator x_n	Performance $x_1(a_1)$ … Performance $x_n(a_1)$	…	…
Criteria Y	Indicator y_1 … Indicator y_n	Performance $y_1(a_1)$ … Performance $y_n(a_1)$	…	…
Criteria Z	Indicator z_1 … Indicator z_n	…	…	…

Box 3 Some software-based applications in MCAs

Because many MCAs aim at calculating a final ranking of alternatives, it typically involves software packages. There are a number of multicriteria algorithms and corresponding packages available (see e.g. De Montis *et al.*, 2005). In the table below, SMCE may in principle be carried out with any of the outranking methods (see also **Box 1**).

Approaches	*Methods*	*Brief descriptions*	*Available software*
MAUT	Weighted summation	It generates a ranking of alternatives based on the specification of quantitative criteria scores and relative importance (weight) of the effects.	DEFINITE (www.ivm.vu.nl/DEFINITE) (Janssen *et al.*, 2001)
	AHP	Method based on MAUT (Multi-Attribute Utility Theory), with an additive structure of preferences. Preference elicitation is both scores and weights elicitation. Statements on interval-valued ratios of value differences serve to obtain score information for each attribute. These statements are translated into linear constraints. Thus the dominance structures can be determined from a series of linear programming problems.	PRIME (Gustafsson *et al.*, 2001)
Outranking methods	PROMETHEE	This is a widely used multicriteria assessment algorithm. It consists in a preference function associated to each criterion as well as weights describing their relative importance. It aggregates the information by an outranking procedure and finally rank the options.	Decision Lab (Brans *et al.*, 1986)
	ELECTRE II	It generates a ranking of alternatives based on pairwise comparisons. First the extent to which the alternative is preferred above others is looked at based on the weights, then the question to what extent it is dominated by another based on quantitative scores is addressed.	DEFINITE (www.ivm.vu.nl/DEFINITE) (Janssen *et al.*, 2001)
	REGIME	Dominance analysis approach where qualitative scores and weights are processed as ordinal scores. Identification of extreme points allows finding the relative size of the subsets defined by every alternative. The probability that the different alternatives achieve the highest rank is inferred, thus pointing out to one candidate for the final selection.	DEFINITE (www.ivm.vu.nl/DEFINITE) (Janssen *et al.*, 2001)
	NAIADE	Discrete outranking method that may employ qualitative, crisp, stochastic and fuzzy information about the criteria. By employing the concept of semantic distance in the pairwise comparison, the MCE generates ranking of alternatives. Two types of evaluation (a multicriteria analysis and a conflict analysis) may be carried out.	NAIADE (Munda, 1995)

NAIADE, the *Novel Approach to Imprecise Assessment and Decision Environments* is one of the most widely used software packages. NAIADE applies equal weights to all criteria, because Munda saw major difficulties in deriving weights from stakeholders or otherwise. However, most algorithms (including NAIADE) require the definition of indifference or gradual degrees of preference and these have to be associated with the deviations observed between the evaluations. This is a challenging task for which it is difficult to obtain evidence, so the recommendation is that these kinds of parameters are obtained from an open deliberation with the involved stakeholders. The explanation of the technicalities may make this difficult though. In fact, the main weakness of sophisticated methods such as NAIADE is their lack of transparency which may lead to difficulties of acceptance among the stakeholders participating in the SMCE.

2.1.3 Nature of participation

Public and stakeholder engagement starts in SMCE already with the definition of policy options and includes deliberations about criteria, input in the impact matrix, and exploration of results with different parameters. Hence, stakeholder engagement in SMCE is comprehensive and spans the whole appraisal process. However, all involved need to agree on a common framing (the same criteria against which the same options are assessed).

2.1.4 Treatment of criteria and values

Let's take NAIADE as an example. NAIADE is able to deal with both qualitative and quantitative information to assess the impact of the different alternatives and with different degrees of uncertainty, including fuzzy sets (i.e. where the issues are not defined in an unambiguous way). Results are given in the form of a ranking of alternatives according to each criteria and actors' preference, as well as a dendrogram of the coalition formation process (as outcome of the equity analysis – see **footnote 4**). However, caution needs to be taken during its application:

1. The outcome evaluation will always be highly dependent upon the initial contextual settings.
2. When defining the criteria and how to evaluate them, one must keep in mind that NAIADE works on the basis of a pairwise comparison (i.e. relative evaluation).
3. One of the main difficulties lies in defining the preference thresholds (for each social actor and in agreement with the conjunction of the participatory process) for quantitative criteria. Condensing different visions and aims in one number may deliver biased evaluations. A sensitivity analysis is therefore recommendable in view of assessing the robustness of the evaluation as well as the influence of each criterion in the final outcome.
4. In order to avoid biased outcomes, high levels of transparency and participation are required throughout the evaluation process, and especially when defining the referential parameters.

NAIADE is able to deal with very different kinds of data. However, the sophistication of the method may derive in transparency issues

The results of NAIADE include rankings of alternatives and an analysis of possible coalitions

2.1.5 Results

The results include a ranking of policy options as well as an analysis of the different perspectives about the options held among respondents. Depending on the application and requirements of decision-makers, the ranking may be complete or partial; the latter includes the natural statement of incomparable alternatives (e.g. one policy option being much better in the social criteria than another which is much better in the environmental criteria). The results should also include a sensitivity analysis and a clear view of the conflicting character of the criteria and the influence of a particular set of weights.

2.1.6 Human and financial resources

The costs of a SMCE consist of the sum for the deliberative process (organisation and support, payment and expenses of panel and witnesses, hire of venue, costs of facilitation, recording and transcribing proceedings and costs for any related analysis) and the sum for the analytical tasks (institutional analysis, modelling, multicriteria analysis, sensitivity analysis). The team conducting a SMCE study needs expertise in deliberative methods, the relevant disciplines for the impact modelling and multicriteria analysis. As other MCA methods, SMCE requires considerable amounts of data to evaluate each policy option against each criterion, making it rather resource intense. This requirement can be eased somewhat by accepting rough estimates of impacts and by using flexible tools that can make use of both qualitative and quantitative data.

Box 4 Example of a SMCE using NAIADE: Water management in Spain

Moral *et al.* (2006) study and evaluate alternative policies for improving the water supply for the Costa del Sol (Spain). They applied SMCE as an implementation of integrated evaluation and participation objectives of the Water Framework Directive. Eight policy options were evaluated against eleven socio-economic and environmental criteria. To understand the problem and the context, the research team combined in-depth interviews, questionnaires and observation at open meetings, with analysis of secondary material. The interviews and questionnaires were also used to identify policy options and criteria. On the basis of technical information and an opinion poll conducted to evaluate the 'degree of social acceptance' criterion, the impact matrix was completed. As in the previous SMCE studies, NAIADE was used to calculate the ranking as well as a dendrogram of stakeholder coalitions. The results showed that the demand-management options were the highest scoring ones. At the end, a focus group meeting brought together the participating stakeholders to review the results. During the meeting, the inclusion of new policy options was suggested, which were then assessed against the same criteria and the ranking was reviewed again. The research team considered the Costa del Sol SMCE as a successful mutual learning experience for the participating stakeholders and the research team. In their view, the process also contributed to the clarification of conflicts and the creation of conditions necessary to construct a more permanent dialogue process among the stakeholders involved and to work towards a resolution.

2.1.7 For further reading

Key theory:

Munda (1995; 2004; 2008)

Key examples:

- Water management in Sicily: De Marchi *et al.* (2000)
- Tourism and national park management in Spain: Martí *et al.* (2000)
- Windfarm in Catalonia: Gamboa and Munda (2007)
- Irrigation management in Portugal: Antunes *et al.* (2011)

2.2 Multicriteria mapping

2.2.1 Description

Multicriteria Mapping (MCM) is an interview-based multicriteria evaluation whereby individual stakeholders are invited to appraise the performance of core and discretionary options against their own sets of criteria. Like other multicriteria approaches, MCM involves developing a set of criteria, evaluating the performance of each option under each criterion, and weighting each criterion according to its relative importance. MCM prioritises the freedom of participants to include as many different factors as they wish. In so doing, MCM does not impose pre-ordained structures or definitions on criteria or weightings. Participants are free to introduce new options of their own choosing and are not forced to make trade-offs where they are unhappy about this. In the end, it emphasises the exploration of the diversity of different perspectives, rather than artificially combining these into a single picture.

MCM is an interview-based method whereby individual stakeholders are invited to appraise the performance of options against their own sets of criteria, emphasising the exploration of the diversity of different perspectives

Developed by Andy Stirling (1997), a former director of Greenpeace International, MCM seems quite appropriate for a variety of EJO campaigns (see also Stirling and Davis, 2004).

2.2.2 Framing [5]

Consider again the proposal to build a new road through a wilderness area, which would destroy the habitat of a number of rare or threatened species. Participants are recruited on the basis of a stakeholder analysis. The recruitment is conducted in a way that seeks to reflect a broad spectrum of relevant perspectives and to represent in some detail the main dimensions in the policy debate. The team of researchers (or activists) develops a set of core evaluation criteria and core options, which all participants are asked to consider. Participants are then guided by a researcher through their own individual analysis in separate 2-3 hour sessions. As part of this session the participant is asked to consider whether they

[5] The following subsections on MCM are adapted from Stagl (2007) and Stirling and Davis (2004).

would like to add any criteria or options that might be relevant for them for appraising the proposed road through the wilderness area. During the session, the researcher works interactively with a piece of computer software (MC Mapper)[6] to explore the performance of options, against their criteria, under different assumptions. In addition to the quantitative and textual documentation recorded using the software package, the interviews are also audio-recorded for later transcription and analysis. From the outset, the aim is not to achieve a consensus on how to proceed on the road proposal, but to expose the variety of views and to

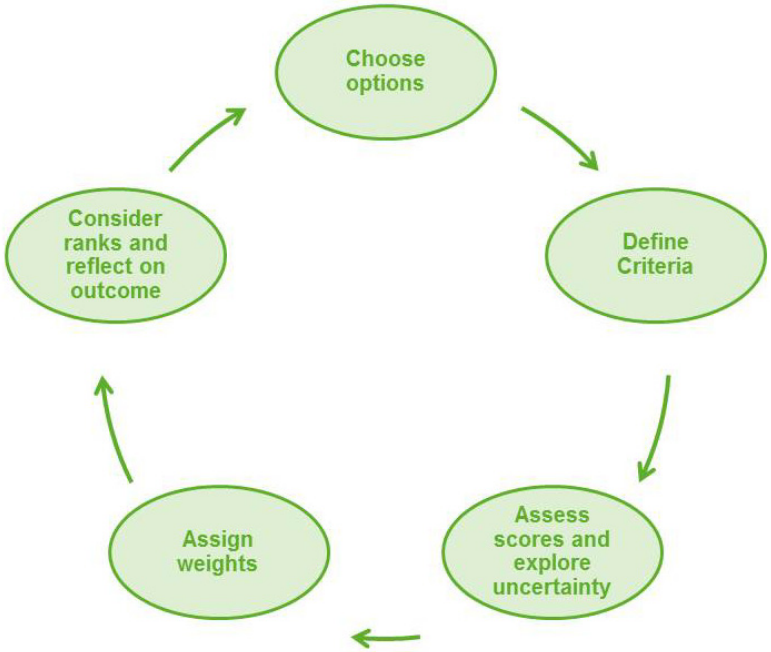

Fig. 2

The six-step process of a MCM

Source:

Stirling and Davis (2004)

try to understand where the differences are most marked and why.

The structure of MCM consists of five main steps as shown in **Fig. 2**:

1. Characterising a wide range of relevant alternative ways to achieve a particular policy aim (options or scenarios)
2. Developing a set of criteria to represent different viewpoints on the issues that are relevant to the appraisal of those options
3. Evaluating each criterion in turn with numerical 'scores', to reflect the performance of each option under each criterion for a given viewpoint

[6] MC Mapper records during the interview the options and criteria (core and additional), the scores for each option using each criteria (one under the most favourable assumptions, one under the most pessimistic conditions) and the criteria weighting; it also allows to review the final picture of option performance and to make any necessary adjustments. The software is free for non-commercial purposes.

4. Exploring uncertainties in the data (by asking respondents for scores under optimistic and pessimistic conditions) and assigning a quantitative 'weighting' to each criterion that reflects the relative importance of their criteria to the interviewee. In contrast to the relatively technical business of scoring, this weighting process reflects intrinsically subjective judgements over priorities and values
5. Calculating an overall performance rank for each option under all the criteria taken together for a particular viewpoint. MCM uses the 'linear additive weighting' procedure, in which the rank simply represents the weighted sum of normalised scores. Next, the ranks and other elements of the appraisal process are considered. After seeing the ranking of options, participants are free to alter their weightings or scores in the light of this, with the objective of arriving at a final overall pattern of ranks, which they feel accurately represents their personal perspective. Sometimes, this review prompts participants to define new options or criteria, or even to reconsider aspects of scoring. In such cases, the interviewer should encourage the participants to justify their reasons for any changes.

The advantage of MCM is the simplicity and transparency of the analytic process

One of the advantages of MCM is the simplicity of the algorithm and the subsequent transparency of the analysis process. MCM avoids the distinction between impacts and preference functions, which simplifies the algorithm and might increase the 'buy-in' of participants. Rather than seeking to produce a single aggregate 'answer', the MCM tool is used to explore how differing assumptions, priorities and value judgements shape participants' individual appraisals. Of course, depending on the viewpoint, this may be seen as an advantage or a disadvantage.

2.2.3 Nature of participation

The participatory process in MCM differs significantly from the two other methods in this review because stakeholders are interviewed individually. It is assumed that, because of their role in an organisation related to the issue in question, they would have deliberated with others about the most important aspects of the issue before the interview. This is a characteristic that cannot generally be assumed for citizens. In MCM, the participants do not need to agree on a common framing, i.e. individual respondents can add criteria and options during the appraisal process, and these will be reported together with the appraisal of core criteria and core options.

MCM uses the appraisal process as a way to gain a systematic picture of the precise way in which different perspectives vary on the issues and options in question. This generates a rich body of information concerning the reasons for differing views, as well as their practical implications for the overall performance of the selected options. In this way, MCM tries to span the divide between narrow quantitative methods (which directly address decision priorities, but which may be insensitive to wider considerations) and broader qualitative approaches (which can accommodate more diverse perspectives, but can have difficulty focusing on

the context of the decision). Particular features of MCM that allow this unusual combination include:

- A core set of diverse options are precisely defined in advance by the research team for purposes of comparison, but participants are also free to redefine those options or add additional ones.
- Participants are entirely free to choose and define their own criteria (rather than having these imposed upon them), but this does not affect the comparability of the final results (which are in terms of 'performance').
- Careful attention is given to the exploring and documenting of 'uncertainties' – the way in which performance may vary for any individual participant, depending on assumptions or context
- a clear picture of performance is given under each individual viewpoint and the method allows these to be aggregated across groups of participants or all participants taken together (see **Fig. 3**). But the primary focus is on exploring the resulting 'map' of how option performance varies across perspectives, rather than on revealing a single uniquely definitive view (millstone *et al.*, 2006).

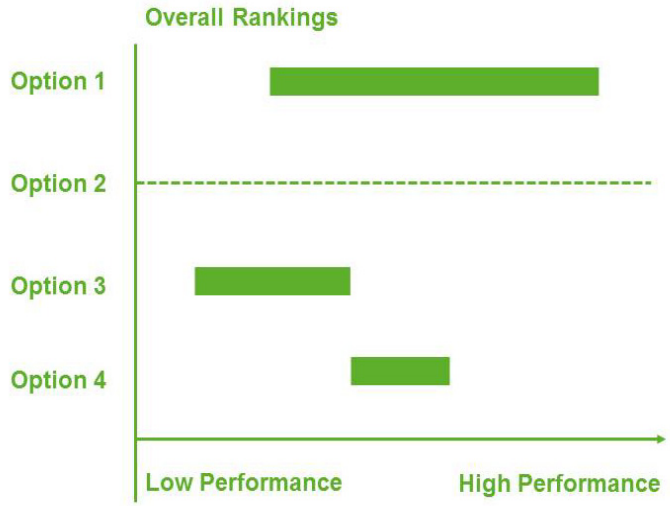

Fig. 3

Example of how a particular participant ranks the different options/scenarios

The final ranking of each option for every participant is displayed on a computer graphic like the above illustration. In this example:

Option1 has the widest range and – at its best – ranks highest overall.

Option 2 was ruled out on principle by this participant

Although – at its best – Option 3 overlaps with part of the distribution for Option 1, at its worst it is ranked lowest overall

Option 4 has a narrow range of performance relative to 1 and 3 and ranks second overall

Source: Stirling and Davis (2004)

By combining a tight focus on decision options whilst at the same time 'opening up' the practical implications of different real-world perspectives, MCM tries to avoid a serious – but often neglected – problem suffered in common by economic, decision and risk assessment techniques, as well as by many more qualitative deliberative and participatory approaches. This problem concerns the way in which such methods claim, aspire or are interpreted to provide a single uniquely robust, rational or legitimate picture of option performance, irrespective of the divergent uncertainties, interests, priorities, and values associated with different expert and socio-political perspectives. Where they are used to 'close down' policy debates, such methods are being employed in a fashion that undermines their own fundamental founding principles of rationality or inclusion. To the extent that it

avoids such untenable attempts at 'closing down', MCM is free to adopt the most straightforward of theoretically valid mathematical procedures used in decision analysis, thus enhancing the important qualities of accessibility to participants and transparency to third parties (Millstone *et al.*, 2006).

In MCM, participants can indicate the relative importance of each of their appraisal criteria by means of a simple numerical weighting

2.2.4 Treatment of criteria and values

There are different legitimate values and points of view in society. This creates social pressure to take various perspectives of an issue into account, e.g. economic, political, social, cultural, etc. Stakeholders who represent different interests in society express these values and points of view in the MCM interviews. Related to this is the issue of weighting. In MCM, participants are asked to indicate the relative importance of each of their appraisal criteria by means of a simple numerical weighting. Taken together, these weightings reflect the relative importance of the criteria to the interviewee. In contrast to the relatively technical process of scoring, this weighting process reflects intrinsically subjective judgements over priorities and values.

Since participants provide the scores and weights, these are the main data sources in MCM. Both, quantitative and qualitative information is recorded (MCM Mapper software) and used in the analysis (MCM Analyst software).[7] The ranks are enriched by the results from the analysis of qualitative information recorded during the interview. Interviewees are asked to provide 'best' and 'worst' performance scores. This captures the degree of uncertainty and variability around the performance of particular options under a given criterion. Participants are asked to talk about their assumptions behind these different scores, and this qualitative data is recorded and transcribed. This captures uncertainty about how well the option will actually work, variability within the option, and sensitivity to wider context conditions. This leads to rankings expressed as ranges of values instead of single numbers. These ranges express uncertainty in assigning scores, differences of opinion and variability in performance from context to context, for instance, the differences between good and bad implementation, or between appropriate and inappropriate applications.

2.2.5 Results

The results include rankings of policy options either per stakeholder, per perspectives (i.e. groups of participants), or averages of all pessimistic (left-hand end of bar) and of all optimistic (right-hand end of bar) ranks (i.e. combined weighted scores for all criteria) for core options and for additional options. The interpretation of the rankings is helped by the textual analysis of statements

[7] MCM Analyst includes a central database containing all data relating to all participants, interlinked with text reports for representing in narrative form various permutations in the qualitative data and a spread sheet to process and present quantitative data in the form of charts. The software allows the data to be examined individually as well as by perspectives (i.e. groups of participants), issues (i.e. groups of criteria) and/or clusters (i.e. groups of options). The software is free for non-commercial purposes.

recorded in the software during the interview and from the interview transcripts. The results should also include a sensitivity analysis and a clear view of the conflicting character of the criteria and the influence of a particular set of weights.

2.2.6 Human and financial resources

The costs for a MCM study consist of the sum for interviewing stakeholders (2-3 hours per interview, recording and transcribing proceedings and costs for any related analysis) and of the sum for the analytical tasks (multicriteria analysis and sensitivity analysis). The team conducting a MCM study needs basic expertise in interview techniques and expertise in multicriteria analysis. Compared to other MCEs, resource requirements for MCM are low.

Box 5 Example of a MCM: Genetically modified crops and foods in Europe

Stirling and Mayer (2001) studied the controversial issue of introducing genetically modified (GM) crops and foods in Europe. Claims of unprecedented economic benefits are qualified by concerns over the potential for serious irreversible harm. However, there is considerable scientific uncertainty over the form and magnitude of possible effects. This has led to the evolution of a set of controls which are intended to be 'precautionary' in nature, but the regulatory appraisal process has failed to gain confidence, either on the part of NGOs, private industry, or the general public. This lack of confidence has arisen because, among other things, the scope of the regulatory appraisal is disputed.

Drawing on a variety of perspectives in the UK, a range of agricultural strategies for the production of oilseed rape, including both GM and non-GM options were explored in this MCM study. Participants were asked to consider and appraise six core policy options, which were identified and defined in advance by the researchers. They were: organic agriculture, integrated pest management (IPM), conventional agriculture, GM oilseed rape with segregation and present systems of labelling, GM oilseed rape with post-release monitoring, GM oilseed rape with voluntary controls on areas of cultivation. Participants were able to add up to six further options which they were free to define. Twelve participants were interviewed individually.

The total set of appraisal criteria (117), which were developed by participants, reflects a wide range of considerations viewed from a disparate array of perspectives. The criteria were ordered by the researchers into six dimensions: 'environment', 'agriculture', 'health', 'social', 'economic', and 'other' issues. By contrast with many multicriteria analyses, participants were left relatively free to undertake the weighting process in whatever way they felt most comfortable, with the interviewer providing guidance where requested. Starting from a default position where equal weighting was assigned to each criterion, participants usually began by ordering the criteria simply in sequence of their relative importance. Starting with the least and the most important criteria, the intensity of the differences in importance between pairs of criteria were then addressed by altering the weightings criterion by criterion. This continued in an iterative fashion until a final set of weightings was arrived at with which the participant felt comfortable. Final rankings assigned by participants were calculated and plotted in bar diagrams.

Stirling and Mayer found that the viewpoints of the different participants result in very different ranking orders across the six basic options. They also found uncertainties to be very important; under many perspectives, the worst options at their best rank were higher than the best options at their worst. A number of key findings emerged. First, the GM options clearly perform best overall under the perspectives of only three participants, who are all associated with government or industry bodies. Second, under the perspectives of two participants associated with government or industry bodies, the position was more equivocal, with non-GM options (notably organic) performing better under certain conditions. Third, the voluntary controls regime in general performed indifferently or worst among the regulatory strategies for GM crops under the perspectives both of industry and of public interest group participants. Fourth, the charts display some interesting idiosyncrasies in the rankings derived by individual participants. For example, the pattern arrived at by one participant ascribes a maximum rank to all GM options alike, a minimum rank to all other options, and no uncertainty. This is a result of the scoring of these options under a human health criterion, coupled with a weighting of 100% on that criterion. Finally, the conventional intensive cultivation option tends to perform rather poorly under all perspectives, both with respect to the GM options and with respect to the organic and IPM options (depending on the perspective).

2.2.7 For further reading

Key theory:

Stirling (1997); Stirling and Davis (2004)

Key examples:

- Genetically modified crops and foods in Europe: Stirling and Mayer (2001)
- Hydrogen economy in the UK: McDowall and Eames (2006)
- Policies on obesity in Europe: Millstone *et al.* (2006)

2.3 Integraal framework

2.3.1 Description

Martin O'Connor (2006; 2007) and his co-workers have developed 'Integraal' as a framework for sustainability assessment (see also O'Connor *et al.*, 2007). It consists of six steps, guiding the process of multicriteria and multi-actor assessment and deliberation. The principle is to constitute a 'deliberation forum' that offers opportunities to participants to explore progressively different aspects of the agreed problem. Deliberation exercises can be iterative, allowing participants to go deeper and to gain or exploit more detailed information (e.g. in the choice and mobilisation of different indicators). It can be expected, as collective learning continues, that new policies for addressing the issue or sub-issues will be identified, new issues, stakeholders and values may be declared, and new information or analysis requirements may be highlighted.

Integraal's principle is to constitute a 'deliberation forum' that offers opportunities to participants to explore progressively different aspects of the agreed problem

Integraal thus offers a systematic, evolving and easy-to-use framework potentially very useful for EJOs. The associated online software (called 'kerDST' for Deliberation Support Tool) will soon be improved in an updated version.

2.3.2 Framing

The structure of the Integraal framework consists of six main steps (**Fig. 4**) that will be described one after the other:

Step 1: Identification by the stakeholder community of the **social choice problem**, or range of options. The objective of this task is to deliver the context, the scale, and the dynamics of the exercise. According to the level of participation, this step can be accomplished by researchers or in a more participative way.

Step 2: **Organise** the social choice problem **in terms of the actors** concerned, the situations or options being assessed, and the value criteria. This means developing in a pragmatic way typologies or classifications of: (1) the stakeholders who are impacted by the problem or by the impact of the means of addressing it; (2) the policies, strategy options, or scenarios to be appraised; and (3) the issues against which the performance of the policies, options or scenarios will be appraised (for example: preservation of the environment, decent work, health, etc.).

Step 3: Identify and **mobilise information and tools** for system representation (e.g. maps, models of processes and systems, studies, diagnosis). These information and tools can help to 'ground' the deliberations in a robust knowledge base and, more particularly, this will assist in populating catalogues of indicators representing the stakeholders' reference points when working to evaluate situations and scenarios. This step leads to the definition of indicators and to the organisation of a database of indicators.

Step 4: Mobilise the actors for tasks of **deliberation**. This step relies on the framework and information developed in steps 1-3 above. It produces outcomes in the formal sense of a multi-actor multicriteria evaluation. It also provides insights and learning to participants via the discussions that take place and observation of the respective positions adopted and of how these evolve through the collective learning that occurs. The deliberation step can be organised in three sessions: a preliminary session, the evaluation session using the software kerDST,[8] and the deliberation session (see below).

Step 5: **Communication** of results and recommendations. This step includes, but is not limited to, the final reporting stages of an evaluation exercise. It also includes all tasks 'along the way' of information sharing relating to the design and preparations of deliberations, documentation of discussions and intermediate results (see below).

Step 6: **Reflection** on the outcomes obtained and, in an iterative sense, return to Step 1 of the process in order to review the entire evaluation sequence or, as seems fit, to formulate new specific evaluation problems.

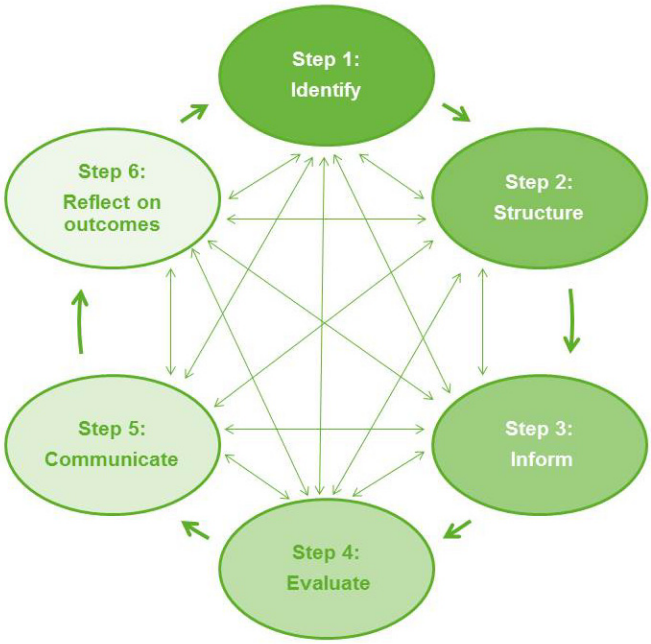

Fig. 4

The six-step process in the Integraal framework.

Source: O'Connor *et al.* (2010)

2.3.3 Nature of participation

In Integraal, participation (or, more exactly, deliberation) is seen as essential to the evaluation process (in **Step 4** above). Deliberation exercises of current performance or future options are undertaken in a multi-stakeholder multicriteria perspective at appropriate scales (e.g. from farm to region to nation), corresponding to defined contexts or 'theatres' of collective debate and action. There may be, in principle, many discrete evaluation exercises that can be loosely coupled by engaging common typologies of stakeholders and performance values, or by considering the same or analogous strategies. The deliberation step can be organised in 3 sessions:

In Integraal, deliberation exercises of current performance or future options are undertaken in a multi-stakeholder multicriteria perspective at appropriate scales

1. A preliminary session: Once information is gathered, all participants, representing stakeholders, can be invited for a presentation of the preliminary results, which leads to settling the axis of deliberation (categories of performance issues, scenarios or alternatives, and any forgotten stakeholder). Adjustments can be made at this phase. The discussion on scenarios or alternatives will take place only in the second session. The aim of this first session is to explain the method, reinforce the contact with the stakeholders, and increase their willingness to participate in deliberation.
2. The evaluation session: During this session, the facilitation team proposes a deliberation support tool, for example the KerDST deliberation matrix. This tool can be used to organise the interfacing of the options for evaluation relative to the stakeholders and relative to the performance criteria (see also below).
3. The deliberation session: The actors enter a process of arguments and negotiation on the best alternative(s) since the previous session, by giving their preferences. The aim of the third meeting is to compare and discuss the evaluations of the different groups. Each stakeholder group will be handed a document with the results of his category, with the indicators which supported his/her evaluation. To improve the quality of the debate, the facilitator can manage the debates towards the key messages and the future possible evolutions. To conclude, a balance must be done on proposals and actions to develop on the basis of this deliberation exercise.

2.3.4 Treatment of criteria and values

In the Integraal framework, criteria and values are preliminary defined in step 1 and then affined in **step 4** through the deliberation process. In step 4, the participants are invited to give their perception of the performance of the scenarios according to the different performance issues, by filling up the matrix. The evaluation can be done by gathering all the actors or it can be done in several sessions, by categories of stakeholders and geographical proximity. Deliberation

[8] It is available on a specialized website. http://kerdst.kerbabel.net/

initiates at this stage, on the basis of the analysis of the preferences of the different actors: where their evaluation regarding each scenario and each performance issues diverge or converge, in order to reach a possible 'best' solution.

2.3.5 Results

Results are flexible and may include a 'best' final solution or a ranking of options. The communication of results must take place around all aspects of the social learning process and its outcomes: e.g. the framing of evaluation tasks, the selection of indicators, the determination of reference values (by whom, for whom?), and the reporting of outcomes of multicriteria evaluations. A great number of documents might be produced, many destined to remain unpublished in a process punctuated by higher-profile benchmark and strategic reports, brochures, and scientific publications. Management of these products (e.g. on a website) becomes a significant task in itself.

The online tool KerDST (Deliberation Support Tool) generates results by providing users with a multi-stakeholder multicriteria deliberation framework that can be applied to any desired situation of choice or discussion. It integrates the KerBabel Deliberation Matrix and the KerBabel Indicator Kiosk. The Deliberation Matrix helps organise actors, issues and scenarios of a debate in a deliberation structure, which can be visualised and mobilised online as a 3-dimensional structure. The Indicator Kiosk gives users the option of creating and choosing indicators that allow them to document and justify each vote that an actor gives on one scenario regarding one issue.

2.3.6 Human and financial resources

The costs for an Integraal study consist of the sum for building a relevant indicator database, organizing three to six deliberation meetings, and carrying out the analytical tasks. The team conducting an Integraal analysis needs basic expertise in focus group techniques and in multicriteria analysis. Like SMCE, an Integraal study requires considerable amounts of data to evaluate each scenario and several meetings with stakeholders, making it rather resource intense. This requirement can be eased by accepting rough estimates of impacts and by limiting deliberation opportunities.

2.3.7 For further reading

Key theory:

O'Connor (2006; 2007); O'Connor *et al.* (2007); Frame and O'Connor (2011)

Key examples:

- Uranium mining in Niger: Chamaret *et al.* (2007)
- Sustainable agriculture in New Zealand: O'Connor *et al.* (2010)
- Sustainable agriculture in the Île-de-France: Da Cunha (2010)
- Biodiversity change in the Île-de-France: Maxim and O'Connor (2009)

Box 6 Example of Integraal: Sustainable agriculture in New Zealand

O'Connor *et al.* (2010) discuss design principles in a programme of applied science and stakeholder consultation on sustainable agriculture in New Zealand. They report procedures and tools for building deliberations around agriculture performance, societal responsibilities and regional planning challenges, focussing on the question of how effectively to mobilise knowledge from different sources and at different scales about environmental and economic systems to address sustainability policy challenges. Integraal's six-step framework is used as a basis for identifying different types of deliberation tasks carried out through dialogues facilitated by social science researchers and consultants, engaging scientists, decision-makers and other stakeholders. The authors highlight, with examples from workshops engaging representatives of New Zealand farming and regional government stakeholder communities, how the individual deliberation tasks can be effective as 'piecewise' contributions to social learning and capacity building for addressing the dilemmas and complex information needs of contemporary sustainability challenges. In this way, integrative perspectives can be applied progressively, at modest cost and in a decentralised way, adapted to local circumstances and changing needs.

This 'piecewise' approach to deliberation has demonstrated the value of applying the process in an iterative manner over several workshops with a committed set of participants. The collaborative learning that occurs throughout the process is the most important outcome and the challenge is how to involve a large number of people in a manner that will expose them to the viewpoints of other stakeholders and allow for informed deliberation around some of the challenges in achieving sustainable pathways.

An important feature of the Integraal method proposed via the kerDST system is that it seeks to provide for a progressive development of a complex evaluation problem, in a way that remains accessible to a wide spectrum of stakeholders as well as experts and that can be broken up into bite-sized activities that nonetheless cumulate over time. A feature of kerDST is that the same procedure for problem framing can be used, whatever the facet of the larger question being posed. In this way the people involved develop a familiarity with a common tool, a common procedure and – more fundamentally – a common appreciation of the nature of 'social choice' as a multi-actor multicriteria decision situation involving trade-offs and dilemmas. None of the 'pieces' gives a complete picture of the challenges facing the actors for sustainable agriculture. However, cumulatively this process of piecewise deliberation seems to be effective as a way of building collective capacity for addressing complex challenges.

3 The example of 'leaving oil in the ground' in Ecuador and Nigeria

Now that we have described what a multicriteria problem is and how it is possible to handle it, can we interpret Environmental Justice issues in this framework? Let's take, for instance, the well-known proposal of 'leave the fossil fuels in the soil'.

3.1 Context

The slogan originates in the socio-environmental conflicts of Ecuador (Rodríguez-Labajos and Martínez-Alier, 2012). Since 1972, the country had witnessed a continual expansion of oil exploitation in the Amazon rainforest. Numerous studies have shown that these operations have not brought economic development, and have caused instead considerable social and environmental damages in the areas of exploitation, as the recent Texaco-Chevron case has put in evidence.[9] This situation, plus the debates on climate change, led the EJOs Acción Ecológica and the Oilwatch network to propose a new initiative in Kyoto in 1997, namely to 'leave oil in the ground' in areas of high biological value and threatened indigenous populations. This was in the aftermath of Texaco's disastrous legacy in Ecuador and of the killing of Ken Saro Wiwa and other Ogoni activists in Nigeria by the

[9] In 2011, the company has been condemned to USD 18 billion, after 28 years of exploitation of oil, for the damaged caused.

military dictatorship in 1995 because of their complaints and actions against Shell in the Niger Delta.

Indeed, the situation is perhaps even worse in Nigeria. In a study analyzing the practices of Shell in Nigeria, Professor Richard Steiner of the University of Alaska observed that “Throughout 50 years of oil production, this ecologically productive region has suffered extensive habitat degradation, forest clearing, toxic discharges, dredging and filling, and significant alteration by extensive road and pipeline construction from the petroleum industry. Of particular concern in the Niger Delta are the frequent and extensive oil spills that have occurred. Spills are under-reported, but independent estimates are that at least 115,000 barrels (15,000 tons) of oil are spilled into the Delta each year, making the Niger Delta one of the most oil-impacted ecosystems in the world” (quoted in ERA, 2009).

Left: **The map showing the location of the Niger Delta (Source: www.crudeoildaily.com);** ***Middle:*** **Oil spill in Niger Delta (Source: http://thecasualtruth.com/);** ***Right:*** **View of the Niger Delta from space (Source: NASA).**

The moratorium proposed by Oilwatch in 1997 was transformed into public policy after Rafael Correa became president of Ecuador in 2007. His administration officially put forward the Yasuní ITT initiative in early 2007, against the idea of selling the approximately 850 million of barrels of heavy oil from the ITT fields. This represents one-fifth of Ecuador’s oil possible reserves. The Yasuní is biologically an extraordinarily rich area, which as a National Park is excluded in principle from oil exploitation. It is also a refuge for some Waorani peoples in voluntary isolation, the Tagaeri and Taromenane. Revenue from selling the oil, counted at present value, would perhaps reach USD 7,200 million. Ecuador was ready to make this sacrifice but asked the outside world to contribute to it (USD 3,600 million, over 10 years) on the grounds that Ecuador is also contributing to world objectives by this scheme. Ecuador is asking therefore for only half the estimated opportunity cost, a sum that will be used in development projects and social programs. But according to Acción Ecológica, the commitment to leave the oil in the soil must be accomplished even without the achievement of the monetary contribution. Indeed, for Acción Ecológica, the proposal’s fundamental goal is to launch the transformation of the country into a ‘post-oil society’.

This idea is spreading. In 2009, the Nigerian EJO Environmental Rights Action (Friends of the Earth Nigeria) sent a proposal to the government to ‘Leave new oil

in the soil' (ERA, 2009), while other initiatives are on the march (in Bolivia, Guatemala, Colombia). This is perhaps best symbolised by the creation of a new expression, 'to *yasunize* a territory' (Rodríguez-Labajos and Martínez-Alier, 2012).

Left: **The map showing the location of the Yasuní National Park (dark green) and the Huaorani territory (green) (Source: www.wikipedia.org);** ***Right:*** **White-banded Swallows perching of a tree stump on the bank of Rio Tiputini, Yasuni National Park (Source: www.wikipedia.org).**

3.2 Is this a multicriteria problem?

Being highly political and sensitive issues, the oil situations in the Yasuní, the Niger Delta and elsewhere, seem to have all the attributes of multicriteria problems. Extractive activities in general (including oil exploitation) are indeed major issues of 'social choice' or, more frankly perhaps, of social conflicts. This is because they are at the same time a huge source of revenue, usually for a tiny minority of people as in the Niger Delta, as well as a considerable source of environmental contamination and health damages, especially on the populations living nearby exploitation sites. They also generate other economic problems that are typical of countries that depend on this sector.

More than 50 years of fossil fuel extraction has resulted in severely depleted reserves. As a result, the 'commodity frontier' is on the march. Oil exploitation is now arriving in areas where natural and human diversity are very sensitive and vulnerable and other types of hydrocarbons are in the target. Any changes have potentially dramatic consequences on life conditions and on ecosystems. In such situations, is oil exploitation worth its costs at local, national and international levels?

This is the type of question where multicriteria assessments may bring some light, taking into account multiple issues and multiple actors from different sectors and spatial scales. Because costs and benefits are unequally distributed among different stakeholders (e.g. local populations, governments, Northern consumers,

Nature), exploiting vs. leaving oil in the ground is typically a multicriteria problem where MCEs, with the largest participation possible, can instruct stakeholders through the elaboration of a common understanding of the issues involved in the choices to be made. MCEs fill the gap left by conventional economics by allowing comparing scenarios along several dimensions and criteria.

The Yasunisation multicriteria problem can be constructed in different ways: yasunisation as an option, options for on-site yasunisation, priority areas for yasunisation … Which one reinforces the EJOs working on the 'leave oil in the soil' question?

3.3 A preliminary way to understand the multicriteria problem

In order to structure the multicriteria problem, we must define three fundamental categories of information: (1) the alternatives/scenarios/options considered, (2) the stakeholders involved, and (3) the dimensions, criteria and indicators for evaluation. These three categories are not only 'technical' questions. They are also deeply political and also subjective questions, but this doesn't mean they cannot be defined on a reasonable and common basis, understandable to all actors through participation. This phase is obviously delicate and key to everything else.

There are several ways of framing the 'leave oil in the soil' question – several 'yasunisations' are possible. A yasunisation for a 'post-oil' society? A yasunisation for 'green-washing'? Only three basic *scenarios* (or alternatives or options) will be briefly described here:

1. *Leaving fossil fuels in the ground without any prior financial condition:* in this scenario, a country gives priority to long-term social and ecological sustainability, launching the building of a 'post-oil society'. This scenario may include notions such as socio-ecological transition, selective degrowth, rights of Nature, etc.
2. *Leaving fossil fuels in the ground, with international contribution:* we assume in this scenario that there is an international support for, say, half of the economic loss coming from the decision of leaving oil in the ground over a given period of time. This scenario may include notions such as ecological debt, international solidarity cooperation, etc.
3. *Leaving fossil fuels in the ground, within a 'market environmentalist' framework:* in this scenario, the 'yasunisation' is seen as way to obtain financial advantages (in the form of any financial support, carbon credits, REDD-type projects, Clean Development Mechanisms, use of the brand 'Yasuní-ITT', etc.) while fundamentally continuing business-as-usual.
4. *Exploitation of fossil fuels:* in this scenario, the government allows activities related to fossil fuels exploration and exploitation in the area considered. Usual legal and political procedures are followed. This scenario may or may not include (1) policies aimed at mitigating the environmental and social impacts through cleaner processes and (2) the use of the state income for environmental and social programs.

We now suggest a list of possible *stakeholders*, keeping in mind that each case study will be unique and more complex. We would typically have:

- The government: It includes primarily a given administration in exercise, but can also encompass the legislative bodies taken as a whole. According to the needs, it can of course be divided into smaller units (the ministry of the environment, for example, may more or less strongly disagree with the ministry of the economy, etc.).
- The capitalist sector:
  - Companies related to oil extraction: international and national oil companies in prospection, exploitation, transport.
  - Companies not related to oil extraction but dependant on the oil extracted.
  - Companies working in the environmental sector (e.g. carbon trading, renewable energy, eco-tourism, sale of environmental services).
  - Companies using the Yasuní initiative to 'green' their image or production pattern
- 'Local populations': this category includes all local people who feel affected by the multicriteria problem, urban or rural:
  - The 'elite' (upper and middle classes): landlords, wealthy farmers, medium/small business people, local politicians, state employees and professionals.
  - Lower income groups (working class and peasantry): poor/middle farmers and wage-earners (including those in oil companies!).
  - Indigenous people (isolated or not), with their own socio-environmental parameters, different from those which operate in the rest of the national context, many of them being self-reliant producers.
- Civil society organizations (CSOs): since the 1980s, the importance of CSOs has been central in many 'social choice' problems. This category includes, but is not restricted to, EJOs. Their role must be critically examined as they may represent opposite trends (e.g. 'environmental justice' vs. 'green capitalism' currents). They often work with other national and international organisations.
- International organisations: to be defined according to the cases (UN, IMF, World Bank, creditor countries, etc.).
- The academic sector: researchers who are involved or who show interest and provide expertise in the multicriteria problem. We include in this category the national and international scales.

- Nature can also be added as a stakeholder – its rights have for instance been acknowledged in the Constitution of Ecuador.

We then identify *criteria* that express best, in a broad and preliminary way, the issues related to the 'social choice' problem of leaving oil in the ground or not. They are classified hereafter in *dimensions* conventionally named 'environmental', 'social', 'political' and 'economic', but others could be identified (e.g. 'cultural', 'spiritual'). The purpose of criteria is to identify and evaluate the environmental, social, political and economic impacts and benefits of (not) exploiting fossil fuels. Additionally, *indicators* – quantitative or qualitative – are needed to measure the performance of each scenario for a given criteria. Tentatively, we could have the following dimensions, criteria and indicators:

- Environmental:
  - Respect and caring for biodiversity, forests and watersheds: This criterion aims at representing the importance of ecosystems in the site, and the way in which it would be affected by the three scenarios. This criterion is important at the local level but may also be relevant for the national and global scales. The concept of Rights of Nature is relevant here. Examples of indicators: number of plant and animal species, number of endangered species, number of ecosystem types, etc.
  - Environmental quality: This criterion represents the capacity of natural ecosystems to provide goods and services necessary for human well-being in each of the three scenarios. It would be possible to start with the classification of *The Millennium Ecosystem Assessment, Ecosystems and Human Well-being: Synthesis* (2005), which provides a classification of ecosystems goods and services. These functions are important mainly at a local scale but are also useful at the national and global levels. It also possible to find other approaches relevant to the relationship between ecosystems and human well-being (e.g. spiritual, psychological and cultural values). Examples of indicators: forest area, specific bio-indicators, types of ecosystem services, etc.
  - Climate change: Greenhouse gas are emitted at two levels, during the production process and as a consequence of the combustion of fossil fuels produced, at the consumer level. Examples of indicators: CO2 emissions, deforestation, etc.
- Social:
  - Autonomy and respect of the rights of indigenous peoples: This criterion is related to the (non-) respect and self-determination of indigenous populations with their knowledge, worldviews and ways of life. Examples of indicators: evolution of land rights, socio-cultural and political sovereignty, etc.

- Same for smallholder farmers.
- Welfare programs for the local populations: This reflects social security and opportunities provided by the government, in this case, mainly as a result of the revenues generated by oil companies or other sources (international funds, etc.). It mostly concerns the local population and groups, but also improvements at a regional or national scale. Examples of indicators: the standard social indicators as applied to local populations (yearly investments in health, education, culture, etc.).

- Political:
  - Power relations: It is impossible to forget that the stakeholders participating in the MCE are not equal in terms of power and influence. Who are the most powerful stakeholders? What are the dominance/subordination relationships among stakeholders? How will power distribution evolve with or without a given scenario? Examples of indicators: evolution and distribution of income and political power among the different stakeholders, etc.
- Economic:
  - Economic opportunities for the livelihood of lower income sectors: This criterion represents the economic gains for local and national populations. It measures the 'health' of the local economy in the different scenarios. Examples of indicators: meaningful employment rate, income distribution and evolution, yearly investments in useful infrastructure, etc.
  - Economic opportunities for the capitalist sector: This criterion highlights the empowerment gain of the business sector. Examples of indicators: the standard monetary indicators (investments, capital structure, GDP, etc.).

3.4 The Yasuní case: partial example and limits

A recent study has applied a multicriteria software to the Yasuní situation (Vallejo *et al.*, 2011). We will briefly review it here, as well as some critical points made by Oilwatch.

Vallejo *et al.* (2011) recently carried out a SMCE using the software NAIADE (see above). They defined two basic scenarios. The first one – 'Plan A' – following the Yasuní-ITT proposal 'leaves oil in the ground' based on the project initiated by the Correa administration in 2007. This scenario entails, among other, the respect for indigenous territories, the protection of biodiversity, the development of the eco-touristic sector, and less CO2 emissions globally. The authors also analyse variants of this scenario, with less optimistic indicators. The second scenario – 'Plan B' – is centered on the extraction of oil in the Yasuní (except the Ishpingo sector). Also, the authors added a variant with a larger area of exploitation. The

Plan B scenario is based on three assumptions: that the corresponding revenue made by the state will be redistributed (e.g. in the form of social programmes), that there will be social and environmental costs even with the most modern extractive technologies, and that this scenario will foster the economic growth of the related oil-dependent industrial sector. These assumptions are quite favourable to the extraction scenario because the authors' intention was to compare the Yasuní-ITT proposal with the 'best possible' conditions for oil extraction.

These scenarios were evaluated by using a number of indicators that could be gathered into seven evaluation dimensions that formed the multicriteria matrix: (1) local economy (direct income of each alternative, tax revenues from oil revenues by the state, indirect revenues associated with each alternative); (2) 'health' of the national economy (economic growth, diversification of production, vulnerability of the economy on the long term); (3) environmental dimension (biodiversity, pollution due to oil, deforestation, induced or avoided CO2 emissions); (4) social dimension (the opportunity of direct and indirect jobs generation, investment in social development); (5) cultural dimension (effects on culture, effects on the population's living conditions, potential environmental conflicts, capacity for social participation, opportunities for self-determination); (6) governance and social cohesion (breaches in physical conditions between groups in the population, institutional mechanisms for inclusion or exclusion, sense of belonging to society and to the groups that integrate it); and (7) international relations (the country's international position in the negotiations on climate change and biodiversity conservation, the country's influence in the regional integration process). In brief, the authors then elaborated an impact matrix and ran the NAIADE software along the three standard steps, namely comparison of pairs of alternatives, aggregation of all criteria, and then ordering of the alternatives. In short, their MCE gave a clear result in favor of plan A as long as at least 50% of the requested compensation is obtained.

Acción Ecológica and Oilwatch criticised this study, based on a number of points.

1. Oilwatch contests the 'Plan A' scenario which is built on a strong pro-market basis. Indeed, this scenario promotes financial mechanisms that Oilwatch rejects, namely carbon trading, REDD-type projects, the promotion of 'eco-industries', the sale of environmental services and Clean Development Mechanism (CDM). These instruments, to remain brief, are seen as harmful ways of green-washing global capitalism: "These carbon market-related projects are used in many parts of the world – including Ecuador – to justify and expand extractive activities, energy mega projects and other plans that entail deforestation and loss of biodiversity, as well as being used to neutralize resistance" (Oilwatch, 2012).
2. Oilwatch contests the criteria and indicators used, seen as too narrow and unable to shed proper light on the problem. Within the 'sustainable economy' dimension, for example, Oilwatch (2012) argues that "The indicators are similar to those used in any cost/benefit analysis, such as economic growth [...]; productive diversification [...]; and the vulnerability of

Tools such as multi-criteria analyses and assessments can be useful, but when there is a disconnection with local processes, they can be confusing and even dangerous

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the economy [...]. A sustainable economy should be based on sovereignty: economic sovereignty, food sovereignty, energy sovereignty, etc."

3. Oilwatch rejects the strategic usefulness of a MCE at this particular moment of the struggle. The Yasuní-ITT initiative is indeed still very fragile and Oilwatch favors the strategy of 'scandalisation' and increased pressure, instead of acknowledging a MCE that doesn't take other views into account but promotes 'green' financial approaches. "Th[is] MCA presents a mutilated vision of what has been an agenda constructed over the course of many years" wrote Oilwatch (2012). Ultimately, the first condition for any yasunisation remains the willingness of local populations to exploit oil or not.

Indeed, what is the legitimacy of a MCE if important stakeholders (such as EJOs) do not acknowledge any of the scenarios evaluated? Also, what is the legitimacy of a MCE if EJOs feel betrayed by the indicators used? The keyword answer to avoid this is: *participation/deliberation*. From the beginning, a realistic MCE on an issue such as 'leaving oil in the ground' *must* include the participation of stakeholders in order to have as many reality-checks as possible. It is in the essence of a MCE to be able to acknowledge *all* positions, including the most radically opposed ones. "Acción Ecológica believes that tools such as multi-criteria analyses and assessments can be useful, but when there is a disconnection with local processes, they can be confusing and even dangerous" (Oilwatch, 2012). Activists (even of the most radical kind) who find it potentially useful to participate in a MCE that will rank alternative positions (including their own) must help building scenarios, criteria and indicators that will eventually make it clear that their positions is the most reasonable. They should also be able to oppose the use of some misleading indicators (such as GDP) provided that they can convince a majority of stakeholders that these indicators will only add more confusion to the MCE. But for such a process to be possible at all, a convincing MCE must involve substantial participation.

4 Conclusions

MCAs are tools not aimed at fostering conflict – which can sometimes be the only constructive thing to do – but they are instruments that provide opportunities for discussing, learning, understanding, convincing, and that may strengthen the activist side, including, simply, by fully legitimising their values and viewpoints.

In their campaigns, EJOs may therefore find it useful to have a rigorous MCE showing the (in)adequacy of a given scenario – according to their viewpoint – within a given multicriteria problem. As we have seen, MCEs ultimately aim at ranking the alternatives according to an ordering that is a legitimate synthesis of the criteria, themselves qualified by relevant indicators. Generally speaking, however, there is no solution optimising all criteria at the same time and reasonable compromises have to be found. When compromising, power relations between stakeholders and the issues of their representativeness may become extraordinarily important. Powerful actors with minimal representativeness should be dealt with vigilantly.

We have reviewed three major techniques of MCE for EJOs. Within EJOLT, expertise can mainly be offered for two of them, namely SMCE and Integraal. The respective characteristics of these methods can be summarised as follows in **Table 2** (adapted from Stagl, 2007):

More broadly, the subjectivity of MCEs, common to every evaluation process, has to be treated with great caution. The 'royal road' to more justice, when dealing with subjectivity, is to choose/design MCE processes where criteria and indicator selection, as well as weighting and aggregation steps, are performed with substantial participation of a broad group of stakeholders in order to account for different interests and values. Participation is the only way to validate the overall structure and framing of the MCE analysis. It should however be noted that participation is a necessary condition but may not be sufficient for reaching transparency and accountability.

Technically sound MCEs may not be well received by EJOs if aspects and values important to them are neglected. Substantial participation of a broad group of stakeholders is a necessary step of MCEs for enhanced environmental justice

Approach	Origin of criteria	Trans-parency[10]	Public and stakeholder engagement	Outputs that the approach is good at producing	Indicative costs (EUR 1000)[11]	Indicative time (month)[12]	Overall relevance for EJOs
SMCE	stakeholders and/or research team	**	**	Complete or partial ranking	30-50	4-8	**
MCM	stakeholders and research team	***	**	Map of perspectives and ranking, discourse analysis	20-30	2-6	***
Integraal (full version)	stakeholders and research team	***	***	Learning and ranking through deliberation	20-50	4-8	***

Table 2

Characteristics of the three methods described in this guide

Source: adapted from Stagl (2007)

[10] Transparency is rated higher, if participants have the opportunity to go through the whole process and if the tools applied are simple and can be easily explained in a workshop.

[11] The costs are taken from Stagl (2007), except for Integraal. They represent very rough estimates for a medium size standard application and may vary significantly for specific applications.

[12] Time required is influenced mostly by whether the method requires several stages of public and stakeholder meetings or not.

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