PARADIGMS FOR SUSTAINABILITY ASSESSMENT:

Inventory of Costs & Benefits versus Representative Diversity of Indicators

BACKGROUND PAPER IN SUPPORT OF THE SEEA 2010 REFORM PROCESS

— ACCOUNTING OF ENVIRONMENTAL DEGRADATION —

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§1. INTRODUCTION

A large number of recent books and journal articles have highlighted links between changes and challenges to accounting practices and decision support for sustainability.[1] While this is a field of theoretical reflection and pragmatic experimentation whose ecological economics precursors go back more than 30 years (e.g., Victor 1972; Hueting 1980) and whose literature is fragmented across many different contexts and domains, there are nonetheless several signs that the field of enquiry is maturing. A wide range of approaches have by now been devised with a view to ensuring that various categories of social and environmental change are "taken properly into account" in the course of project and policy evaluation.

Sustainability Assessment (henceforth SA) is concerned with what sorts of guiding concepts, frameworks and information sets might be appropriate for decision support as we enlarge our scope of concern from economic affairs narrowly defined, to the ecosystems of the planet and the long term.

Established economic valuation methodology has sought to extend concepts of 'rational' and 'optimal' resource use (including various forms of monetary cost-benefit analysis) to environmental systems, and also across time through the quantification of environmental damages and of cost-benefit trade-offs through time (raising the problem of "discounting"). This extension of scope has been pursued notwithstanding the fact that, given the distributional conflicts between present and future and the ethical and culturally-based disagreements between existing interested parties, a cost-benefit "optimizing" approach based on a concept of inter-temporal efficiency is indecisive (on theoretical grounds alone) as a desideratum of societal choice. To this we might add that, as we turn our attention to the long-term, the evaluation of benefits and risks (due to accidents, pollutants and ecosystem disruption, among other things), pose difficulties of high uncertainties and the irreversibility of many effects, fuelling the divergences of opinion within present day society about the basis for resolving questions of risk acceptability and fairness in exposure to risks. [2]

Thus, distributional concerns and the diversity of ethical positions, alongside system complexity and uncertainty, are often cited, negatively, as reasons for the difficulty or inappropriateness of monetary valuation as a basis for sustainability assessments. It follows that these same features can also be declared positively, as properties of the world that scientifically based SA procedures would like to represent and address.

Based on a synthetic review of systems complexity and ethical considerations as factors determining limits to the scope of monetary evaluation procedures, this Background Paper sets out a discourse theoretic approach to SA that is obtained through embedding multi-criteria representation and evaluation methods in a multi-stakeholder deliberative evaluation process. We will develop the argument that Sustainability Assessments can be developed through mobilising a *representative diversity of indicators* (qualitative and quantitative, monetary and non-monetary) with reference to multiple bottom lines. The agreed set of multiple bottom lines and the selection of indicators must be validated by reference to the full spectrum of stakeholders in sustainability.

This notion of *a representative diversity of indicators* relative to *multiple bottom lines* is set in dialectical opposition (along both methodological and epistemological planes) to the notion of an "inventory" of costs and benefits, or of direct and indirect impacts of a project, or of changes in capital stocks (etc.) that is necessary for the construction of any single-bottom line or "aggregate" SA indicator (such as CBA based measures, or macroeconomic 'genuine savings, etc.). The approach in terms of *representative diversity* is more parsimonious and more robust as a basis for achieving effective stakeholder mobilisation around

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[1] For example, Bebbington, Brown & Frame (2007) on accounting technologies and sustainability assessment frameworks in corporate (business) settings, the collection edited by Lawn (2006) on sustainable development indicators in ecological economics, the review article by O'Connor & Steurer (2006) on the relation between evaluation methods and concepts of adjustments to macro-economic indicators in green national accounting, each of which gives access to important components of the relevant literature.

[2] As is commonly complained (in a large literature that we will not review here), the practice of discounting to obtain net-present-values does *not* reconcile future interests with the present, most often it simply "discounts" future values. Conversely, the less the future is discounted, the more weighty in the cost-benefit scales become the imponderables of uncertainties about longer-term change. See for example, O'Connor (2001) and Bebbington, Brown & Frame (2007), and the works cited there.

complex and challenging regional sustainability issues. It accepts pragmatically that, in prevailing conditions of complexity and stakeholder diversity, many significant SA concerns cannot be made the object of reliable quantification, and that monetary information on costs and benefits can, at best, only be partial. Although useful systems measurements and model-based quantifications can be obtained for a great variety of features, there is a need to work synthetically with an ***amalgam*** (and not an aggregation) of qualitative as well as quantitative elements of description and judgment, and of non-monetary as well as monetary information sets.

This Background Paper provides a review of one of the key methodological questions of "accounting technologies" for sustainability assessment work — that concerning the roles of, and the relations between, qualitative and quantitative information and between monetary and non-monetary 'metrics' for quantified information. Starting with the prima facie naturalness of MCDA (**Section §2**), we will alternatively consider the push towards monetisation (**Section §3**) and the arguments for a deliberative process approach to SA (**Section §4**). As an attempt at 'bridging' between these apparently opposed approaches, we present in (**Section §5**) schematic framework for a multi-criteria multi-stakeholder dialogue based approach to SA that, while not hostile to the use of monetary and other quantitative information, insists on embedding such information explicitly within a deliberative political framework. Notwithstanding the tensions that remain between proponents of monetisation and deliberative approaches, the state of the art for sustainability assessment is best framed in terms of these necessary complementarities. We conclude (**Section §6**) that powerful and robust deliberative multi-criteria multi-stakeholder SA can in this way be achieved with relatively modest resources, as long as some basic conditions are achieved for the effective interfacing of stakeholders and for the mobilisation of a "representative diversity" of stakeholders and information about project/policy options. In particular, deliberative multi-criteria multi-actor SA procedures can be employed at quite low costs in preliminary "scoping" phases of *ex ante* and *ex post* assessments, and then at moderate costs in full integrated assessment exercises, in conjunction with more meticulous modeling, scenario development and data management processes.

§2. THE NATURALNESS OF MCDA

Sustainability is a multi-facetted challenge, and hence there is a certain naturalness to a multi-criteria indicator based approach to SA. In practical terms, sustainability assessments must admit, and work with, at least four broad categories of information, ranging from:

- "Weak signals" where diversity and content may be very rich but also ambiguous;
- Qualitative information that has a clear sense in the role of indicator;
- Quantitative indicators within a multiple dimensional space of 'metrics' of measure;
- Synthetic indicators established with a single unit of measure (e.g., some forms of CBA and adjusted GDP estimation techniques, and also some classes of 'ecological footprint' calculation techniques).

Reading the SA literature, we can identify two poles that act as "attractors" for addressing this complexity of information:

- On the one side, a desire for "silver bullet" indicators of 'progress towards sustainability' that pushes SA analysts towards: (1.1) adoption of a single metric, and (1.2) attempts to compose a single 'aggregate indicator' of SD. *We will refer to this as the mono-metrical approach to SA.*
- On the other side, the admission of multiple organizational forms, multiple scales and diversity of 'stakeholder' perspectives and preoccupations that pushes SA analysts towards: (2.1) an *ad hoc* plethora of indicators; (2.2) indecision concerning measurability of 'progress towards sustainability'; and (2.3) interminable argument (going round in circles) because a lack of common ground and too-easy manipulation/changing of grounds. *We will refer to this as the polyphonic approach to SA.*

Neither of these polar positions is wholly satisfactory, and so, neither is stabilised in the SA literature as a robust and legitimate framing of best practice. Some approaches to accounting and assessment remain based on strong underlying ideological positions that push towards the polar extreme of mono-metrical SA. Others, based on different sorts of underlying epistemological positions, seek to render the plethora of weak signals manageable by grouping SA indicators into a smallish number of headings, that here we call **SQPMBLs** (*sustainability quality-performance multiple bottom lines*). As discussed by O'Connor (2006c),

- Sometimes these **SQPMBLs** are explicitly based on 'generic' sustainability preoccupations, e.g., systems theoretic considerations such as the four capitals or the 'four spheres'; and

- Sometimes they are obtained empirically, e.g., identifying the strategic goals or governance issues for a specific business context or territorial authority or national agency (etc.);

Often these qualitative considerations will be reflected in or translated into analytical representation tools, such as systems dynamic models or "full cost accounting" frameworks. Environmental degradation (or, more exactly, its reduction) is almost invariably one of these **SQPMBLs**. This makes *MCDA* (*multiple criteria decision aid*) seem a self-evident approach for organising information for appraisal of business performance, country performance, and public policy alternatives (at whatever territorial scales).

A great variety of multiple criteria analysis methods have been developed and applied in recent years, in efforts to help organise scientific as well as economic information as a basis for sustainability assessment and decision-making. Typically, monetary valuation procedures can be incorporated alongside other methods for identifying the nature of the choices and trade-offs in question. The basic premise of *multi-criteria decision support analysis* (*MCDA*) is that the resource requirements and effects of alternative course of action may be comparable in a number of different ways, but that the information cannot easily be brought into a single unit of measure (cf., Munda 1995, 2004; Martinez-Alier, Munda & O'Neill 1999).

MULTI-CRITERIA APPRAISAL OF PRIMARY ENERGY ALTERNATIVES

Primary energy sources for modern economies include (among others) uranium, coal, natural gas, and photovoltaic capture of solar radiation.

* These are all *strongly commensurable* in terms of their electricity (kilowatt-hours) or thermal energy (kJoule) yields. On this basis, stock and flow limits to available supplies may be calculated, and various methods of process and input-output analysis may be applied to *compare* net energy yields, energy intensity of alternative feasible economic structures, and so on (Peet 1992).

* Yet, the different fuels are more difficult to *compare* in terms of the environmental pressures associated with their use. What common unit can be used to quantify trade-offs between: dangers and costs of eventual safe disposal of spent reactor fuel and other radioactive wastes; effects of coal combustion gases on climate patterns (greenhouse gases), on acidification of water through sulphur and nitrogen oxides, and on low-level smog; silicon chip solvent residues in ecosystems; visual impacts of wind farms; toxins from waste incineration; and so on? From a social choice point of view, the energy alternatives are only *weakly comparable*.

MCDA approaches generally do not rely on the commensurability of different dimensions of value. This means that they do not, of themselves, provide a unique criterion for ranking or choice; rather, they are intended to help frame the problem in a way that may help arriving at a judgement based on negotiation or compromise. Such methods help to characterise alternative courses of action, allowing analysts, decision makers and other interested parties to compare the alternatives on the basis of this multi-facetted profiling. Whatever the quality of the descriptive measurements that can be carried out, it is difficult to escape from the multiplicity of criteria for judgement (see, for example, the inset box on *Primary Energy Alternatives*).

The key issues in choosing the MCDA "looking glass" for sustainability assessment and decision making concern the advantages and disadvantages of sacrificing full commensurability of valuations (widely argued to be one of the chief merits of monetary CBA methods), in favour of ways of presenting information for decision-making procedures that do not give a unique ranking but make more explicit the sorts of trade-offs that might be identified by or with regard to the spectrum of sustainability's stakeholders. In this regard, the challenges for MCDA approaches are twofold.

- First, they must live up to the claims of making 'more explicit' the ways that alternatives are evaluated and compared. Theoretical and empirical analyses can, in practice, become very technical, due to the wide range of information categories and modeling that analysts may attempt to bring together in order to facilitate comparisons between alternatives.
- Second, and related to the first, the technical aspects of the analysis need to be embedded within wider social processes so that formal and mathematical analyses can be made responsive in a structured manner to stakeholders' preoccupations with environmental and socio-economic concerns (cf., Joubert et al., 1997; de Marchi et al., 2000; Gamboa & Munda, 2006).

Both of these considerations refer directly to the relation of stakeholders with the analysis. Therefore, the accent is placed on the *use of the method as a social process* as much as on the formal assumptions of the MCDA analysis. Although MCDA representation frameworks can seek to be very comprehensive (e.g., "full cost accounting", "cradle-to-grave" life-cycle analyses, etc.), the mass of scientific (including monetary) information does not speak for itself. No matter which strategic choices or policy options are identified, compared and measured, decision making will involve choices between divergent interests, dilemmas over

values and, necessarily, *a process of conflict resolution*. A scientifically and socially robust evaluation will reflect this complexity and the terms of its resolution.

§3. AMBITIONS AND LIMITS OF MONETISATION AS A STRATEGY FOR SA

An important part of integrated economy-environment accounting for sustainability can be developed in monetary terms. [3] A reason commonly put forward for monetary valuation of changes in "external" conditions is to provide a common and understandable measure through which different objectives can be traded-off. Placing money figures on impacts gives a quantification of the scale of beneficial and adverse effects, and thus also of the investment and adjustments that might be needed to compensate communities, restore damaged environments and avoid further damages. In conventional economic terms, the *internalization of the environment* in evaluation practices has both descriptive and normative dimensions. It requires: (a) developing ways of estimating in monetary terms the "opportunity costs" associated with alternative uses of economic and environmental resources, which means placing monetary values on environmental goods and services (and also environmental bads); and (b) choosing the course of action that is judged to be the best for the society.

Nonetheless, experience of the past 30 years shows that the production and exploitation of project or policy evaluation information in monetary units is by no means a simple affair.

- From an *accounting* point of view, there is a wide range of questions about which conventions to adopt for the classification and aggregation of data (including aggregation across time), and for the imputation of monetary values for quantities that are not in reality the object of a monetary transaction.
- From an *economics* point of view there are, in addition to these quantification points, a range of theoretical and empirical considerations for interpreting accounting and modelling results via performance concepts such as efficiency, optimality, social benefit, or sustainability.

The focus of this section is to review the challenges of *imputing* money values to changes in social and environmental conditions external to the monetized sphere, and the limits of this practice for the production and organisation of information useful in support of sustainability analysis and policy.

Let us consider in this context, the treatment of the physical environment as comprising *stocks of natural capital* that furnish *environmental goods and services:* that is, primary energy and other natural resources, waste assimilation services, recreational amenity, and life-support functions.[4] Given that natural capital is limited, there are constraints on availability and trade-offs between different uses (present and future). Therefore, valuation of these natural capital stocks and the flows of benefits obtainable from them (or reductions in flows due to pollution or other degradation) may be attempted through making estimates of shadow prices reflecting opportunity costs along the same lines as opportunity costs for produced commodities and economic capital goods bought and sold in markets.

The necessary conditions for establishing monetary commensurability in this sense are very restrictive. Strictly speaking, the opportunity costs of this or that use (or non-use) of an environmental resource are quantifiable only within a tightly formalized modelling perspective which allows the defining of the relevant set of interdependent production-consumption-conservation (etc.) possibilities for the ecological-economic system and for the time frame in question. One modelling framework for characterising sustainability that, since the 1970s, has had widespread exploitation is inter-temporal "general equilibrium". For didactic purposes we will accept this approach as exemplary. A typical feature is the reliance on mathematical constrained-maximization techniques to define "optimal growth", "optimal natural resource use" or "optimal pollution abatement" trajectories for the economy in question, by some form of net-present-value maximization with (usually) a positive time-discount rate.

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[3] In this paper we mainly discuss environmental impacts, referring to changes in biophysical conditions (including impacts on health, comfort, etc.) that may be 'negative' or 'positive' from different points of view. We restrict discussion of the "social dimension" to what is necessary for framing environmental valuation questions. .

[4] We consider natural capital as one component of the "four capitals model" which, with many variations, has widespread currency in the ecological economics and sustainability accounting fields. For an exposition in the context of the recent European project SRDTOOLS, see **Ekins, P. (2006),** ***Evaluating Regional Development in terms of Sustainable Development Using the 4-Capitals Model*****,** Contribution to the SRDTOOLS Final Report, PSI, London, October 2006.

Such model solutions are often interpreted, in SA or development policy advice contexts, as analogues of a perfect competition general equilibrium having "first-best" Pareto-efficiency properties.[5] Under certain fairly standard and, as it happens, highly unrealistic analytical assumptions, one can establish that model trajectories characterized by a set of (shadow) equilibrium relative prices for all economic and environmental goods and services (present and future) — *these prices including the interest rates from period to period* — that correctly signal the relative marginal productivities and the relative marginal utilities, hence the opportunity costs — *including inter-temporal opportunity costs* — on all margins.

This has been the basis for, among other things, normative SA interpretations proposed for monetary measurements of changes in a nation's or a company's natural (as well as human and built) capital stocks — notably the concepts of *genuine savings* (net change in capital stocks of a nation) and the *weak sustainability indicator*. A national economy is described as "weakly sustainable" if its genuine savings are non-negative.[6]

In reality we are always a very long way from a theoretical "first-best" situation such as these models formally portray and, in fact, this approach to environmental valuation as a contribution to SA actually raises into view more imponderables than it resolves. It has been demonstrated formally, within these same intertemporal modelling frameworks (e.g., Asheim 1994; Pezzey 1997; Pezzey & Withagen 1998; Faucheux, Muir & O'Connor 1997) that little can reliably be inferred from measurements of current prices, economic outputs and environmental changes as to the potential for a sustainable economic output, nor as to the conformity or divergence of present economic activity compared with sustainability requirements.[7] In order to get beyond this situation, the analyst would need to be able to answer a multitude of questions such as: *Which model is the "right" one for value estimation purposes? What functional forms and parameter settings are plausible?* These questions do not have easy answers. It is now part of the received wisdom of environmental and ecological economics to assert:

- There is much scientific uncertainty, and it is difficult in any case to reduce the complexity of biophysical cycles and ecological processes from local to planetary scale as required for sharp mathematical specification of "inter-temporal production possibility frontiers";
- With any chosen modelling approach, there will be valuation indeterminacies associated with the sensitivity of the equilibrium relative prices (measuring the opportunity costs) to the distribution of property rights and prevailing power structures;
- There are deep problems with empirical measurements of all the relevant ecosystem and social variables, even if the theoretical specifications were resolved. These include the difficulty of achieving complete inventories of all significant environmental damages in the short and long terms.

The net result is great difficulty (or indeed impossibility) — partly theoretical, partly empirical — of estimating in any meaningful way the inter-temporal opportunity costs associated with complex environmental functions.

These obstacles to applying monetary valuation methods as a basis for SA are present at all scales. They are intrinsic to the nature of the methods themselves *relative to the classes of phenomena (or evaluation problems) being addressed*. They arise directly in the context of the attempt to transpose traditional economic valuation methodology into an arena for which it was not originally devised and where (upon closer inspection) it may not be able to be applied in a conventional way. These extensions are:

- Spatially and materially to the non-produced and largely non-commodified natural environment;
- Temporally to the long term of ecological change and sustainability concerns;

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[5] The presumption behind most monetary valuation work in the neoclassical tradition is a (theoretical) reference state with a "Pareto-efficient" resource allocation. This is called "first-best". If given an explicit model representation, this "first-best" would often be an equilibrium satisfying the rule of *maximum present value of economic output (henceforth NPV-max) or, as a variation along the same principle, maximum present value of utility (henceforth PVU-max)*. However, the points of argument that we rehearse here are generic and do not depend on specific features of the welfare or capital theoretic modeling approaches.

[6] One of the early articles advancing the 'weak sustainability' criterion and some steps towards empirical estimation was Pearce & Atkinson (1993). An example of the World Bank's promulgation of genuine savings as a sustainability assessment for developing nations is Hamilton & Clemens (1999). For some overviews of the pros and cons of this approach to the definition and estimation of macro-economic sustainability indicators, see Brouwer, O'Connor & Radermacher (1999); O'Connor (2001), O'Connor & Steurer 2006); and Faucheux, & O'Connor (2001).

[7] These formal demonstrations had been anticipated, correctly, by Norgaard (1990).

- Discursively to an open-ended spectrum of sustainability values associated with cultural diversity and ways of life.

It should here be emphasised that the extension of a method of representation, analysis or enquiry proven in one domain, into new domains, is a standard principle in the 'handbook' of creative scientific practice. But, this creativity does not necessarily, immediately — or in a simple way — lead to scientific success. This uncertainty about the success of an excursion into new terrains is also a part of the scientists' handbook. The pushing back of frontiers in this way can, indeed, sometimes lead to scientific revolutions — e.g., the limits of classical mechanics as established by, on the one hand, high speeds (leading to relativity theory) and, on the other hand atomic and subatomic scales (leading to quantum theory), and, on another hand again, the passage from two to three orbiting bodies (Poincaré's precursor to deterministic chaos theory).

In short, it is sometimes with *surprise*, but also sometimes through an *ironical* exercise of exploring new territories with methods and concepts known or suspected to inadequate for the task, that we lead ourselves to invent new ways of charting the newly discovered territory.[8] Yet, in the case of economics and valuation theory for integrated economy and environment accounting, we are not as disoriented as were the physicists with the "breakdown" of their cherished classical mechanics around the turn of the 20th century. We are better prepared because, in fact, economics and the related social sciences have quite long and strong traditions of thinking about distributional questions, about the indeterminacies of the long term, and about the dilemmas associated with societal collective choice questions.

This leads us to propose that, in order to progress in our formulation of guidelines for integrated economy and environment accounting, we need to accept the intrinsic limits of monetary valuation approaches to SA not as limits to scientific practice but, rather, as keys to approaches from the point of view of complexity.[9] We cite two main features:

- **1. System complexity (associated with autonomy and indeterminacy) of the natural processes upon which human activity depends.** Ecosystems are not markets, and the biosphere processes do not necessarily unfold "harmoniously" in accordance with coherent governing principles. If the biophysical milieu is treated as "exogenous" and invariant relative to a commodity production system, then under certain conventions a system of prices can be defined for the opportunity costs between different economic commodities. But once environmental changes are admitted as significant, this analytical convenience breaks down. The biosphere evolves, locally and globally, under the influence of forces that are largely independent of human action; it is now also subject to uncontrolled (and increasingly severe) perturbations that are "side-effects" of human economic activity. The complex habitats that furnish life-support functions for human and other species cannot be produced in factories. Restoration of ecosystems that are damaged or altered through economic activity or pollution is often impossible. Ecosystem change and biosphere dynamics are not controllable by human intervention in the same way that commodity production processes are. For all these reasons, the provision of many environmental services and also of harmful effects, is characterized by time-irreversibilities by incommensurabilities.[10]
- **2. Distribution conflicts and the multiplicity of societal values.** Ecological harms include the risks and burdens falling on people as a result of pollution or exploitation — for example disturbed or degraded ecosystems, interruptions to ecological life-support cycles, carcinogenic substances and toxic substances in workplaces and in homes, and loss of food production capacity. The unplanned effects on ecological distribution will, in many cases, fully emerge only over long periods of time and across large distances (Martinez-Alier & O'Connor 1996). The interested parties may be extremely diffuse (for example people suffering from health problems induced by or aggravated by urban pollution or carcinogenic substances), or hypothetical in character (future generations that may be affected by climate change, accumulation of toxic wastes). Moreover, people in their different cultural settings articulate their sense of value about themselves, their communities and nature in multi-layered ways (O'Connor 2000a). The significance of nature, and of built environments, is embodied in a person's or a community's way of life, in their institutions and taboos, in their principles and precepts of right conduct, their habits and forms of cooperation. Very often, explicit value statements about the environment emerge only when these principles are compromised or ways of life are threatened: "value" then is associated with social processes

[8] This theme of scientific progress through irony is developed by O'Connor (1999) following Stengers (1987).

[9] Although the term complexity has many legitimate usages, we employ it here with reference to the writings of Jerry Ravetz and Silvio Funtowicz on a post-normal practice of science and knowledge quality assessment (Funtowicz & Ravetz 1990, 1993), to evoke classes of decision situations where uncertainties are large, the stakes are high and values diverge.

[10] For some ecological economics entrées into what has become a very large literature, see Passet (1979), Godard (1984); Peet (1992); Norgaard (1994); O'Connor (1989); there are many more.

of controversy and conflict. So valuation should be taken broadly to refer to people's notions of what matters for the future, and why. These choices for the "distribution of sustainability" often cannot be quantified, or can only partly be quantified, often only in non-monetary and somewhat speculative terms. Nonetheless, these arbitrations and compromises over survival, expansion and disappearance of different forms of life, economies, ethical and aesthetic sensibilities, constitute real resource management decisions.

In short, over and above scientific uncertainties about economic and ecological evolutions, there are also irreducible social obstacles to specification of opportunity costs in monetary terms. These are linked, for example, to notions of rights to life or property for other people or other species, to people's individual and collective senses of the sacred, or to natural or built features that are paramount matters of local identity. In order to allow SA to be framed incisively we must address the question *which sustainability commitments to uphold, why and for whom?* The simple invocation of abstract considerations such as "balance", "symbiosis" or "sustainability" as reference concepts, does not serve as a decision criterion. It does not, for example, guarantee the conservation of specified productive or reproductive potentialities of any particular society or ecosystem. Nor does it assure the sustaining of all the particular economic interests, communities, or ecologies thus given hope. Once sustainability is the desideratum, we must highlight the realities of human actions (and policy choices more particularly) engaging *decisions about the distribution of sustainability:* which interests and forms of life will be sustained, and which ones left behind, relinquished, destroyed or left to rot?

Once this proposition is accepted, it is not in fact necessary to base SA on speculative and counter-factual propositions about the money value of environmental assets and damages. A more robust approach is to confine monetary aspects of valuation to questions of the economic resources that must or might be committed in order to avoid specified hazards or categories of damage or to ensure the maintenance of specified dimensions of environmental quality or forms of community. The economic logic of valuation will then be: *first make the proposition to sustain/conserve the forms of community or environmental features in question (e.g., avoid the production of toxic wastes, preserve a designated forest system, or the biological diversity, or other feature of nature), and then investigate what commitments this does or might entail* (O'Connor & Martinez-Alier 1997; Brouwer, O'Connor & Radermacher 1999; Faucheux & O'Connor 2001).

§4. AMBITIONS AND LIMITS OF DELIBERATIVE PROCESSES FOR SA

Must discussion about monetary valuation as compared with discursive and multi-criteria evaluation, centres on aggregation and compensation across criteria, which raises the issues of comparability and commensurability. Martinez-Alier, Munda and O'Neill (1999) have, in this context, proposed two sets of distinctions:

- Between *strong commensurability* (existence of a common measure of the different consequences of an action based on a cardinal scale of measurement) and *weak commensurability* (common measure based on an ordinal scale of measurement);
- Between *strong comparability* (there exists a single principle of comparison by which all different actions can be ranked) and *weak comparability* (one has to accept the existence of multiple criteria of judgement, hence conflicts between all different consequences of an action).

It is important here to note that there are descriptive questions of measurability (the first distinction) that are distinct from questions of normative comparability (the second distinction). Whatever the quality of the descriptive measurements that can be carried out, it is in any case difficult to escape from the multiplicity of criteria for judgement. In this regard, according to Martinez-Alier, Munda & O'Neill (ibid.), *weak comparability* appears as the 'natural' philosophical base of multi-criteria evaluation.

From a decision-making and policy assessment point of view there are both advantages and disadvantages of sacrificing the ideal of full commensurability of valuations. Many MCDA approaches seek to present information for discussion and decision-making procedures in ways that will not yield a unique assessment (ex post) or ranking of options (ex ante) but that help to make explicit the sorts of social choices and ecological and economic trade-offs that might be involved.

- The disadvantage of this approach is the greater complexity in the way of framing decision problems.
- The advantage is the richer and more transparent appreciation of the significance to different communities of interest of the choices to be made.

Choices about sustainability goals and priorities are unavoidable. The ways that they are made can vary from straight-out violence to patient efforts at accommodation of distinct interests. It is not so much a choice "for" (or against) sustainability", as it is a question of resolving socially the question *"sustainability of what, why and for whom?"*

The confrontation of different communities or constituencies — all of which are, one way and another, the "stakeholders in sustainability" — is a problem of *arbitration over multiple ends and purposes*, and not of the best use of means for prior agreed to ends. Just as the question of the distribution of well-being across consumers cannot, in neoclassical welfare economics, be resolved by efficiency considerations alone, so the question of *"sustaining what, why and for whom?",* cannot be determined by systems science and efficiency considerations alone. Sustainability is, in this sense, par excellence a *social choice* problem (in the terms formulated by Nobel Prize economists Arrow and Sen), which can be the object of deliberation and reasoned debates but not of a "rational" solution.[11]

Deliberative evaluation processes are intended to exploit the knowledge and deliberative capacities of interested members of the society in distinctive ways, compatible with democratic principles of debate and public accountability (cf. Holland, 1997; Sagoff, 1998, Aldred and Jacobs, 2000). The usual idea is not to replace or by-pass existing democratic structures but to strengthen the democratic process by including within it the considered views of a cross-section of members of the public.[12] The premise is that, given enough time and information, ordinary people can contribute to judgements, recommendations and decisions about complex policy issues with a quality that would not be accessible through experts' analyses alone. More particularly, it is affirmed that actors in deliberation can build up and exercise judgement capacity concerning social choice dilemmas in ways that are inaccessible to analytical procedures alone. Deliberative process is intended to permit principled discussion and debate, meaning the raising into visibility of the distinct and often contrasting concerns that may be held in different sections of society about justice and equity in economic opportunity, long and short term sustainability, environmental and technological risks, and cultural and ethical justifications for specific nature conservation decisions. The building up of shared understanding can be a crucial component for establishing *mutual trust* between people (and their representatives) and for producing meaningful evaluations.

Formulating a commitment to sustainability necessarily involves the articulation of *multiple bottom lines*. The criterion of *allocative efficiency* may be one of these **SQPMBLs**. But, importantly, it relates principally to *means* and not to the resolution of a society's goals or *ends*. This is why "efficiency" is insufficient in itself, and legitimate as a criterion of social choice only if complemented by other **SQPMBLs** that allow the stakeholder community to construct and resolve the dilemmas of sustainability. The typical sustainability "social choice" problem is characterised, as we have highlighted, by distributional conflicts, value diversity and uncertainty.

[11] In making this link to social choice (Arrow 1963; Sen 1970), we highlight that this argument is not radically new in economics but consists of an extension into new terrains of the old quarrel of welfare economics concerning the inseparability of allocative (efficiency) and distributional (equity) goals and of the need for principles of fairness for resolving any and all significant resource use conflicts (see Samuels 1992; also Martinez-Alier & O'Connor 1996; O'Connor 2002a, 2002b). There are two strands to the argument. First, the further that concerns of environmental policy extend to the "long term" future, the more will inter-temporal distributional considerations predominate, in theory and in reality, over allocative efficiency in policy formulation and appraisal. Second, the further that concerns for environmental "values" extend into the domains of aesthetic and cultural as well as economic appreciation of natural cycles and systems, the more difficult it becomes to apply (or justify) the assumptions of value-commensurability and substitutability that underlie conventional economic valuation methodology. For both these reasons, it is necessary to frame the "social choice" decision making ideals in terms such as coexistence, respect, compromise and fairness — the terms and conditions of acceptability and judgement over what Samuels (1992) has described as the necessary and socially instituted "distribution of sacrifice".

[12] Formally constituted deliberative institutions can be divided into three broad categories (cf., O'Connor & van den Hove, 2001). First there are the existing deliberative political institutions of representative democracies, ranging from local governments through to the national and European parliaments. Second, there are indirect deliberation institutions. These approaches use a group of enquirers who are not directly involved in the issue to consider an issue and recommend a decision to the government or legislature. There are also, under this head, a wide range of processes for what we might call a 'group valuation,' as distinguished from individualistic valuation approaches (such as standardised CVM). Third, there are direct approaches that involve deliberation not by the members of Parliament or by the inspector of a public enquiry but directly by the participants in the controversy or by people selected as broadly representative of those interested and affected.

Thus, the purpose of deliberative procedures and institutions is not to reach an "optimum" in the economic sense; rather it is to determine what might seem a good, legitimate and socially acceptable decision or policy through structured argument and practical judgement (Holland 1997). The premise is that something more than a straight compromise between fixed positions is possible (Dryzek, 1990, 1994; Fishkin, 1991; Miller, 1992; Stewart, 1996; Dawson, 2001). By exposing participants' initial views to one another and to reasoned debate, these views may change and, in this way sometimes be brought closer.

As in all public policy, territorial planning, or collective risk management policy contexts, there is a need in sustainability analyses to identify, appraise and choose from amongst the various different options or courses of action that present themselves. Deliberative social choice procedures do not exclude the use of money valuation for some classes of information. But in general it will be affirmed that there is no single unit of measurement — monetary or non-monetary — against which all principles, purposes and values can be put on a common scale. Sustainability as a social choice challenge must address, and arbitrate over, multiple principles and purposes as *ends* (and not means). This will not necessarily be a consensus process. Many societal and environmental disputes are grounded in differing and deep-rooted principles that may be incompatible. Sometimes different groups of people are unable or unwilling to agree even on a common framework of understanding, let alone to seek out a compromise on actions.

§5. SOCIAL CHOICE VIA MULTI-CRITERIA MULTI-STAKEHOLDER DELIBERATION

To highlight key challenges for the organisation of accounts in support of sustainability assessments, we will draw on recent work by O'Connor & Spangenberg (2007) proposing a multi-step "bottom-up/top-down" process for evaluation of business performance relative to multiple performance criteria of corporate societal responsibility (CSR). This work sought to define indicator-based evaluation procedures that would be sensitive to differences between plants, activities, countries and relevant stakeholder groups and that could bridge the gaps between site-level and higher levels of performance reporting.[13] The resulting guidelines were aimed at CSR reporting work at site level and for defining ways that site-level activity can be interfaced with CSR reporting perspectives at higher levels, but can readily be transposed to generic SA considerations. In effect, O'Connor & Spangenberg (2007) outline four main components of a discursive SA process. These are:

- Identification of SA performance and communication goals: Define the full spectrum of sustainability concerns (viz., **SQPMBLs**) and of relevant stakeholder dialogue contexts;
- Creation or mobilisation of an "Indicator Kiosk" or catalogue that makes an inventory and provides a profile of candidate indicators for use in SA;[14]
- Exploitation of a selection of the "candidate indicators" in any specific SA situation, through a process of stakeholder dialogue with a full spectrum of target stakeholder groups, in order to produce an evaluation that responds transparently to the spectrum of performance issues (the **SQPMBLs**) and stakeholder perspectives;
- Application of a principle of "representative diversity" in indicator selection for a balanced assessment and communication framework from any specific SA situation towards wider contexts, e.g., harmonise company or local authority level SA evaluation and reporting in relation to higher-level appraisal and governance perspectives and reporting requirements and/or, as required, for comparisons from site to site, from company to company, from territory to territory, from country to country.

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[13] O'Connor & Spangenberg (2007) motivate their methodological suggestions by reference to findings of a study carried out during 2002–2004 for the European Aluminium Association (EAA). At a series of industrial sites, suggestions from a cross-section of stakeholders were documented andanalyzed in relation to frameworks for CSR reporting established at international levels. This led to proposals for an information management framework and guidelines that permit the identification of a CSR indicator system responding to a range of communication needs at site or sector-wide level. The work was carried out by the C3ED supported by the EAA "Aluminium for Future Generations" Programme; the principal reports are: Faucheux et al. (2002) and O'Connor et al. (2004).

[14] There are many distinct and complementary sources of information and expertise for obtaining "candidate indicators" to be considered for deployment in a CSR reporting process. These include: (1) Identification directly through a stakeholder consultation process; (2) Appraisal of indicator concepts provided by policy agencies or sector associations, international agencies, etc.; (3) Looking at information sets that the policy agency or the company (etc.) uses for purposes other than SA; (4) Assessment of the indicator concepts identified or deployed at other sites.

In this approach, the principle of a representative diversity is applied both at the level of the indicators mobilised in an evaluation process and at the level of the overall problem framing (spectrum of options or sites, spectrum of stakeholders, spectrum of **SQPMBLs**). Following the fundamental conventions of economics analysis, we frame evaluation in terms of the comparison of one thing or action with another. If an action A is contemplated, the questions may be asked: What is obtained (or gained) by action A? What is lost or excluded by choosing A rather than B (or 'not-A'). Economists speak of the 'opportunity costs' of an action, this being defined as the value of the most attractive alternative foregone.

Earlier in this paper we have set out the dialectical contrast between 'mono-metrical' and 'polyphonic' valuation perspectives. The 'single metric' approach to decision support, which is favoured by many (but not all) economists, is to seek to establish a 'rational' justification for a choice between A, B, C, etc., on the basis of relations of preference. If C is preferred over B, and B is preferred over A (etc.), then C is the highest-valued action. However, this simple principle of establishing preferences, or a ranking of options, is not always easy to apply and does not necessarily resolve a problem of choice. The primary reason, which is relevant for almost all policy problems of any significance, is that whenever choices (A or B or C, etc.) involve or will have consequences for more than one person, judgements may differ as to what is preferable.

	A	*B*	*C*
Alpha	**GOOD**	**VERY BAD**	**MEDIOCRE**
Beta	**MEDIOCRE**	**GOOD**	**VERY BAD**
Gamma	**VERY BAD**	**MEDIOCRE**	**GOOD**

Typically, the different options (A, B, C) will produce differing distributions of benefits, risks and costs for the individuals or sectors of society concerned. We can illustrate this with the notion of a 'conflict matrix'. Suppose that each of three stakeholder groups of a society, *Alpha, Beta* and *Gamma*, put forward their preferred policy, A, B and C respectively. We obtain a profile of judgements such as in the table (*above*), where, as a general rule, no overall ranking emerges.

Selecting between the options therefore requires some sort of 'arbitrage' or ruling over the appropriate distribution of (perceived) benefits, risks and costs — in other words a problem of fairness, justice, equity. In this regard, the different protagonists may not only have divergent interests, they may also propose quite different principles for resolving this "problem of social choice". In our specific context of SA, the difficulties of this "problem of social choice" may be summed up as follows:

- Resource management choices usually relate to complex entities, processes or outcomes, each option (A, B, C, etc.) being characterised by a range of attributes. Comparison of options means comparing a vector of attributes with a variety of concepts, units of measure and criteria. It is not always easy to pass from a multiple criteria appraisal to a ranking of alternatives along a single scale.
- Consequences of choices are distributed in time and, often, different aspects of outcomes (good and bad, as perceived by different constituencies) will have distinctive time profiles, e.g., climate change, radioactive waste decay, fish population dynamics, dilution of chemical pollution by natural processes, coastal erosion.
- For all actions whose consequences will be revealed through time there is uncertainty, due partly to natural system complexity and partly to 'social' indeterminacies such as other decisions not yet made or whose consequences are not yet known. There is also indeterminacy in values due to the sensitivity of any 'preference based' valuation to the principles and parametric assumptions about distribution that will or might be adopted.
- A great variety of different reasons or principles can be put forward as justifications for the acceptability, or not, of different outcomes (including perceived uncertainties and risks, distribution of benefits and costs across different constituencies within society, or across generations through time, etc.). It may not be possible to respect all these quality-performance principles simultaneously; this may be the case for the judgements offered by a single person, or for the judgements offered by a range of sectors. Because the principles may be 'irreducible' (that is, incomparable, in the sense of being grounded in qualitatively different considerations), assessment (ex post or ex ante) can be characterised by dilemmas and — in the case of communication and decisions — the need to yield ground or make concessions of principle, not merely trade-offs on quantitative terms.

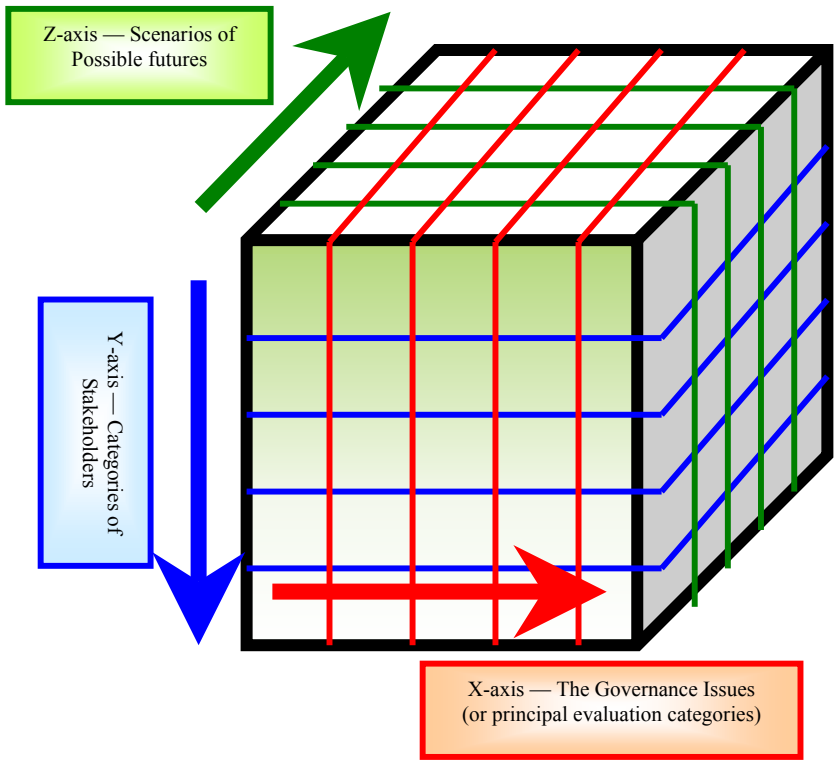
The significance for SA of a plurality of justification principles considered as irreducible (the **SQPMBLs**), can be illustrated by a second 'conflict matrix' (*below*). This again portrays the 'classic' multi-criteria situation where no one option 'dominates' all the others on all criteria. It can easily be admitted that, most often, distinct stakeholder groups will have their distinctive attachments to some principles relative to others, and also they will project their own distinctive 'content' for each of the principles (e.g., justice, equity,

nature conservation, profitability). This leads us to frame the generic problem of 'social choice' as a *multi-criteria multi-stakeholder deliberation* about the merits and demerits of the options for action that present themselves to the society.

	Option A	*Option B*	*Option C*
Principle 1	**Not Applicable**	**SATISFACTORY**	**INACCEPTABLE**
Principle 2	**SATISFACTORY**	**INACCEPTABLE**	**Not Applicable**
Principle 3	**INACCEPTABLE**	**Not Applicable**	**SATISFACTORY**

By bringing together the two 'conflict matrices' introduced above, we obtain a three–dimensional schema, as portrayed in the diagram below. The logic of this schema, referred to in recent work as the **Deliberation Matrix**,[15] is to permit a didactic presentation of the array of judgements that might be offered by *each* category of stakeholders, for *each* of the options or scenarios under evaluation, with reference to a *spectrum* of governance or quality-performance issues (here referred to as **SQPMBLs**).

Formally, by focussing on each cell of the **DM**, the prospect is that each stakeholder class should offer a judgement (e.g., *satisfactory, poor, intolerable*, etc.) of each scenario in relation to each of the key governance or decision issues. One obtains in this way, for each stakeholder (or actor class), a rectangular array of cells, being a layer of the Matrix, within which each row represents the evaluations (issue by issue) furnished by a given class of stakeholders for successive scenarios. Or, looked at from another angle, one obtains the evaluations by each stakeholder, of a given scenario.



What is important is that — as a general rule — this process is not expected to produce a clear conclusion about the 'best' option. It might permit a partial ranking (with reference to any one of the bottom lines, or from any single stakeholder's point of view, etc.). In line with the deliberative philosophy outlined above, the role of the 3-D array as a deliberation support tool (DST) is to provide participants in the SA process with an opportunity of "collaborative learning".

In this framing of SA, the evaluation of scenarios — of *options for action or of options for assessment* — takes place from many different points of view. As the multiple perspectives are brought to bear on a common ground (that is, the scenario set, the agreed bottom lines, the catalogue of indicators visible to all, the list of stakeholders), then the tensions, conflicts of interests, uncertainties and dissent (amongst scientists as well as decision makers, administrators

[15] The **Deliberation Matrix** concept was crystallized, and given a prototype multi-media implementation, in the context of the EC-funded multi-partner **GOUVERNe** project on interactive tools for integrated management of ground water resources (*Guidelines for the Organisation, Use and Validation of information systems for Evaluating aquifer Resources and Needs*: Contract No. EVK1-CT-1999-00043, European Commission 5th Framework Programme, within the Thematic Programme: Environment and Sustainable Development, March 2000 to February 2003). It has been exploited using on-line techniques in several recent and ongoing projects concerned with sustainability indicators, integrated environmental assessment and policy evaluation (see O'Connor 2006a, 2006c). Note that from a mathematician's point of view, strictly speaking, the three-dimensional array is a 'tensor' and not a matrix.

and stakeholders from different walks of commercial activity and civil society) can be expressed and explored in a structured way.

The formal outcome of this exploration is an array of qualitative indicators (the cells of the Deliberation Matrix) that, very often, will not permit the system user or user community to make a simple aggregate judgement or comparison. This places the users explicitly in their political status as actors in a collective process of social choice.

§6. THE PRINCIPLE OF REPRESENTATIVE DIVERSITY

In effect, we adopt here a *principle of representative diversity,* (O'Connor & Spangenberg 2007) both for the selection and mobilisation of indicators and for the overall framing of the system, situation or policy problem to be appraised.[16] **What is sought is not a full descriptive inventory of all system features or system changes, but rather a *reflective appraisal of the most significant considerations from a plurality of points of view*.**

This notion of a *representative diversity* is, from a methodological point of view, set in a dialectical opposition to the notion of a complete *"inventory" of costs and benefits* (or of direct and indirect impacts of a project, etc.) that is necessary for the construction of any single-bottom line or "aggregate" SA indicator (such as 'net benefits' for an investment programme, or 'genuine savings' as a national performance indicator, etc.). This approach in terms of *representative diversity* accepts pragmatically that, under the sorts of conditions of complexity and stakeholder diversity that prevail for major SA situations, (1) many significant SA concerns cannot be made the object of reliable quantification and (2) even when this quantification is available, the process of aggregation would tend to mask over key issues about *what is to be sustained, why and for whom?* Although useful systems measurements and model-based quantifications can be obtained for a great variety of features, there is a need to work synthetically with an amalgam of qualitative as well as quantitative elements of description and judgment.

In this regard, aiming for 'generic' indicators is not necessarily a priority from all points of view, because there are many important issues that are not common to all assessment contexts nor to all stakeholders. Depending on their purposes, analysts may put their focus on individual industrial sites and then consider also the transferability, or not, of indicators suggested at one site to other sites having comparable characteristics. Or they may adopt a territorial focus, at local, regional, national or international scales. It The usefulness of indicators must thus be resolved at different organisational scales, in moving from a site management and communication context to higher-order coordination perspectives (e.g., corporate management and sector federations, territorial administration, national policy). Within each of these coordination perspectives there are good reasons for indicators of a generic character. But, for effectiveness of communications at all levels, there are also good reasons for being attentive to specific features of an industrial site, or sector, or country. The challenge is to bring these two concerns together. Summing up, the discursive approach to SA puts paramount emphasis on two points:

- Building a consensus through discursive processes (direct stakeholder dialogue and/or discourse analyses premised on plurality of stakeholders' visions) for the identification of a parsimonious but comprehensive set of quality-performance categories; and
- Adherence to the principle of a representative diversity of indicators for assessment and comparison across stakeholder classes, issues, options and sites.

The cornerstone for this reconciliation of generic and context-specific sustainability concerns is the use of an agreed set of performance issues to structure information management, stakeholder dialogue and communications. It is to be expected that a discourse based "bottom up" process will throw up a quite heterogeneous spectrum of SA issues and indicators. Therefore, for robustness and legitimacy, this "standard set" of **SQPMBLs** needs to be established and validated discursively, and thereafter re-validated periodically, through a dialogue amongst a cross-section of stakeholder groups. This agreed set of performance categories or "bottom lines" has several important roles to play. Most importantly, it works as a

[16] In brief, the spectrum of **SQPMBLs** and the range of stakeholder categories must be established on the basis of prior discussions and analyses or by real-time deliberation amongst those participating in the SA. The scale of analysis and the range of sites, strategies, options or scenarios (etc.) to be assessed must also be determined.

bridge between the "bottom-up" and "top-down" perspectives, allowing stakeholders at local levels (including local authority staff, concerned citizens, site-based company management, etc.) to see how their particular concerns are examples of categories of social responsibility addressed by the international community, and vice versa. As such, it helps to build a common understanding within and between stakeholder groups, about sustainability challenges including needs and purposes for evaluation, communication and reporting. This enhances prospects for the building and communication of shared meaning and purpose with a relatively small number of indicators and therefore low implementation costs.

In sum, the structuring of a formal multiple stakeholder, multiple criteria SA process in this way, presents the following advantages:

- It permits the transparent organisation and mobilisation of a variety of categories of information and analysis (from diverse sources), with explicit reference to the social choice or governance issues;
- It presents in a didactic and transparent way, the central challenge of an open political process, which is to negotiate some sort of 'compromise' around conflicting interests and with recognition of a plurality of legitimate principles for choice;
- It facilitates, through the mobilisation of stakeholders in different components of the deliberation process, the development of a dialogue capacity between the different classes of knowledge producers (both 'formal' and 'informal') associated with the management problem and also between knowledge producers and the different classes of 'users' of knowledge in the society;
- It provides a framework for a structured discussion and evaluation of the significance, for the policy or governance issues being addressed, of the different forms of uncertainty that may be associated with the various classes of empirical information, modelling and simulation results being introduced into the deliberation.
- Moreover, it is possible to address various methodological questions associated with indicator choice and multi-criteria methodology. For example, 'scenarios' of the consequences for outcomes (the patterns of colours for the cells) of changes to rules or procedures for weighting or amalgamation rules (the passage from indicator signals to higher-level judgements, etc.) can be explored and compared. If the presumption is made that, for a given basket or across baskets, the indicators are (or shall be) elements in a list of commensurate elements, then aggregation is possible and the SA process evolves towards the maximal closure of a single metric approach. At the other extreme, participatory experience can, at any moment, lead to a new specification of the stakeholder categories, of the performance issues, of the scenarios (or methodological options) to be explored, and of the concepts and indicators to be mobilised.

Although our emphasis in this Background Paper has been mainly methodological, we do not forget that only limited resources can be devoted by analysts, companies and public regulatory agencies to their SA activities. These resource constraints must be taken into account at all levels, e.g., locally (municipality, business site), in sectoral appraisals, in public policy and territorial developments, at regional and national administration levels. In this regard, some of the benefits of the discursive SA framework and procedures include:

- A clear framework is provided for assessing and mobilising existing categories of information. Indeed, a "first best" situation (in terms of convenience) can be imagined where a system of SA is based largely on existing information categories available within a company or planning agency and in known external sources (local community, regulatory authorities, national or sector-wide statistics).
- A framework is provided for assessing whether there is a "balanced" coverage of the full spectrum of quality-performance issues (**SQPMBLs**) with adequate consideration to the diversity of stakeholder concerns. As and when unfilled needs are identified, priority can be given to filling the gaps with selected new information via on-site measurement, company research, administrative initiative, or stakeholder dialogue processes.
- The overall SA framework and stakeholder dialogue procedure dominates the individual information components. In other words, the overall framework remains powerful for orienting SA work even if there are changes in the people involved and in the detailed information sets (e.g., changes in the indicators available or chosen to be mobilised). This is an important design feature. Although continuity in information categories and, where possible, data sets, is an important consideration for indicator selection and deployment, there are situations where such continuity is impossible to maintain and where new information categories must be introduced.
- The multi-stakeholder dialogue framework is directly adaptable for a multiplicity of different axes of comparison: e.g., comparisons of sites, policy options, investment strategies or, at a higher level, cross-sector or cross-country comparisons.
- It is also possible, by reflexivity, to propose "comparison of SAs"; in other words, to see how changing assumptions about the framing of the problem or about key parameters alters the outcomes of a SA. Examples of

this could include: (1) changes in the classification scheme for project or programme impacts; (2) different assumptions about the relative roles accorded to monetary and non-monetary information, to quantitative and qualitative considerations, and (more synthetically) to the ideal of an 'inventory' versus that of a 'representative diversity'; (3) specific parameters like time discounting; (4) relative weights accorded to different **SQPMBLs**, or to different stakeholders classes....

The approach in terms of qualitatively established **SQPMBLs** and *representative diversity* accepts that, in our prevailing conditions of complexity and stakeholder diversity, (1) many significant SA concerns cannot be made the object of reliable quantification and (2) even when this quantification is available, the process of aggregation would tend to mask key issues about *what is to be sustained, why and for whom?* There is a need to work synthetically with an amalgam of qualitative as well as quantitative elements of description and judgment. The challenges of complexity are not addressed principally in terms of ever-more-extensive databases and analytical models (although, it should still be emphasised, scientific and statistical quality considerations for data and models remain key dimensions of quality). Rather, they are addressed in terms of building collective intelligence through dialogue and deliberation processes. The main emphasis is placed on *building the problem* — that is, arriving at an agreed set of performance-quality considerations (the **SQPMBLs)** in terms of which the multiple stakeholders will conduct their comparative evaluations of policy or project options. This strategy of *building common ground* at the level of problem-framing is critical for operational SA capacity and penetration of evaluation work into real decision making, because it is effectiveness in problem-framing that will determine the clarity of the "signals" conveyed by the indicators to be deployed.[17]

To conclude, we need to rebuild the relation between deliberative framing of problems and expert quantification of tradeoffs associated with individual and collective decisions. Taking the side of monetary evaluation and cost-effectiveness analyses, it is difficult to reject entirely the idea of assessing the opportunity costs of a policy choice or action. Taking the side of deliberative democracy, it is difficult to speak against ideals of cooperation, open communication of information, and consensus solutions.

- The first approach — monetisation — sets out to quantify 'trade-offs' in the hope that this will provide guideposts for right action.
- The second approach sets out to highlight dilemmas (and their associated, and perhaps illegitimate 'moral trade-offs'), in the hope that the simultaneous consideration of contradictory imperatives will lead to insights as to right action.

These two approaches are often set in opposition; yet, once the intrinsic limits of each approach (monetary quantification on the one hand, and multi-stakeholder deliberation on the other hand) are appreciated, it is obvious that neither the one nor the other alone can provide a guarantee of a successful and pertinent SA outcome. Indeed, when used in an appropriately reflexive way, the two lines of attack may sometimes lead, from opposing starting points, to broadly comparable conclusions. Once the indeterminacy is admitted of 'efficiency' as a choice criterion relative to distribution (and, notably, risk distribution) desiderata, it follows that deliberation is required about the meanings of justice, fairness and respect. In this regard, there is rigorously no such thing as a complete "inventory" of costs and benefits. Nor is their any single 'right' figure for an aggregate sustainability assessment. On the contrary, it is necessary to complement any efforts at quantification of costs and benefits, by a deliberation about what might be an acceptable resolution of *indeterminacies of representation* (of the situations to be assessed) and of the *distribution of (partly determined and partly indeterminate) opportunities, constraints and risks*.

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[17] The diversity of candidate indicators resulting from an *amalgam* of formal expertise and stakeholder dialogue and deliberation processes, organised pragmatically and conducted with limited resources, inevitably will give rise to a sort of *"patchwork" vision of sustainability and its achievement* (O'Connor & Spangenberg 2007; O'Connor 2006c). The societal engagement for sustainability is expressed through an *amalgam* of generic sustainability concerns, context-specific issues articulated by the spectrum of stakeholders, and candidate indicators proposed as elements for detailed evaluation. This means that the SA performance issues and the individual indicators that may be suggested through discursive process, will be of varying scope and of widely varying quality regarding data availability, controllability and possibility for governance. This "patchwork" character, while associated with a rather uneven level of detail and governability in a purely technical sense, is nonetheless both a product of and a necessary condition for stakeholder resonance — a feature that, due to links with acceptability, confidence and legitimacy, is a key consideration for governance success.

At the same time, in a deliberative approach to finding "reasonable" ways of navigating within and through social choice dilemmas, it is important to have a good feel for the magnitude of the sacrifices and compromises that might be entailed by different courses of action, even when these are expressed in qualitative rather than quantitative trade-off terms and even when it is accepted that they are in some ways 'incomparable'.

This necessary integration of stakeholder deliberation with formal expertise, establishes SA as an example of 'post-normal science' in the sustainability field (Funtowicz & Ravetz 1990, 1993). This 'post-normal' practice is emerging in the SA field, not as an a priori ideological position, but as a pragmatic response by professionals — with their attention to scientific, statistical, accounting and technological quality considerations — and other members of the 'extended peer community' to the distinctive challenges of building a knowledge base for sustainability.

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APPENDIX — WAYS AND MEANS OF "PRICING" THE ENVIRONMENT

A.1. PRICING THE ENVIRONMENT IS AN OPERATION OF COMPARISON

The underlying principle for environmental valuation in monetary terms is that although we cannot introduce all ecological goods and services into actual markets, it is nevertheless possible to extrapolate in various ways from actual market transactions so as to get an estimate in money terms of the value of some environmental good, or the cost of some environmental harm. Environmental good or damage may be assessed in terms of its impact (direct or indirect) on other sectors of activity, for example the production of goods having a market price, or it may be assessed on the basis of substitute or complementary goods that do have a price.

During the industrial period, material progress has been seen as synonymous with the augmentation of the quantity and quality of manufactured outputs. Correspondingly, value in economics has meant, foremost and sometimes exclusively, the value of produced goods and services. The services of nature such as availability of air, water, land, were obtained 'free'. In theoretical terms, property rights over land and water allowed the owners to claim a share of the product obtained through using 'their' factors of production, yet the sunlight and air and rain was provided by nature free.

We see here that economics links value to scarcity, and also that it is necessary to distinguish "use-value" and "exchange value". In places where water is abundant, it is often obtainable free of charge; it is nonetheless a fundamental requirement of human life. Thus valuation is a problem linked on the one hand to costs of access, on the other hand to conflict over access under conditions of scarcity. The scarcity may, in turn, be determined in quantity and quality dimensions (such as limited river flows or aquifer renewal rates, but where the availability of water of qualities adequate for drinking or irrigation is furthermore menaced by rising salinity, bacterial contamination, heavy metals, nitrates, pesticide residues and so on). In all respects, though, the preoccupation is with human action and human induced change in the natural world, and the possible repercussions of human actions and human-induced change back on (present and future) human society. Commonly, three broad types of concern may be identified (see Box). It is not just actual damage, but also the threat of loss or damage, which causes concern.

KINDS OF ENVIRONMENTAL DAMAGE:

It is useful to distinguish three main dimensions to the concept of environmental damage:

* It can refer to adverse effects to the physical, chemical and biological systems which are required for the possibility of human life and economic activity being sustained over a long period of time.

* It can refer to the adverse effects of human activity upon the natural world — in the loss of biodiversity, the destruction of habitats and so on.

* It can refer to the detrimental impact of human activity upon aesthetically and culturally significant landscapes and places and the environment as a source of recreation.

The sources of environmental concern are complex, and so these broad categories overlap in various ways.

Now that it is admitted that nature's "services" are not only finite but also depletable, the tendency amongst economists is to extend the notion of opportunity cost to the wider environmental domain. Yet we cannot simply presume that perspectives of cost-benefit comparison that work quite well for commercial project appraisal and for analysis of systems of commodity production and exchange (while presuming that environmental conditions remained roughly unchanged), can be successfully transferred to the entire non-produced domains of our planetary life support systems. Careful attention is required to the physical and temporal scales, and to the analysis purposes for which any particular evaluation method and quantitative results may be appropriate.

A.2. THE "SUPPLY OF" AND THE "DEMAND FOR" ENVIRONMENTAL VALUES

In conceptual and operational terms, the costing of environmental damage in money terms can be approached in two distinct ways:

(i) On the "supply side": by estimates of economic costs — that is, the reduction in other opportunities for assuring goods and services provision — that are or might be incurred in avoiding, abating or repairing damage; and

(ii) On the "demand side": by estimates of the monetary value of the benefits that are lost or at risk — that is, the value of the lost or potentially damaged environmental asset, amenity or service itself.

A.3. ENVIRONMENTAL VALUATION FROM THE "SUPPLY SIDE"

Examples of approaches to environmental valuation from the "supply side" are:

- *Restoration costs* paid (or potentially to be paid) by individuals, firms and state institutions in response to environmental pollution, to maintain or restore buildings, rivers and lakes to certain levels of water quality, fishery stock, etc., or to remedy human health problems due to pollutants.
- *Avoidance costs* incurred (or potentially incurred) by individuals, firms and state authorities to avoid environmental damage: e.g. the costs incurred in introducing traffic calming and noise buffer measures in town; of reducing atmospheric greenhouse gas emissions; of installing catalytic convertors; of improving safety measures against toxic chemical spills in storage, factory use, and transportation; of diverting a road out of a site of special environmental value.

The monetary figures obtained with these "supply-side" approaches relate to *expenditures to achieve improvements in environmental quality or to avoid degradations in quality.* It should be clearly seen that such figures do not necessarily provide an estimate of the monetary value of the benefits gained (or the loss forestalled). In general, actual expenditures aimed to "supply" environmental goods and services — that is, investments and expenditures aimed to avoid environmental damage or to restore an environment that has been damaged — do not necessarily correspond closely to all the benefits that are or might be gained. For example, the restoration benefits of forest replanting might be much greater than the costs to a landowner, but captured by other persons over a long period of time.

A.4. "DEMAND-SIDE" APPROACHES TO ENVIRONMENTAL VALUATION

The non-correspondence between costs-incurred and benefits obtainable (see also paragraph 6 below) helps to explain why a lot of effort has gone into devising techniques for inferring the "demand" for environmental benefits from the hypothetical or observed behaviour of individuals in markets, that is, how much they are willing to pay for environmental costs or to avoid environmental damage.

"Demand-side" approaches involve placing a money value on components of the environment (characterised in quantity and quality terms) or on the services and benefits (etc.) that the environment. This requires some way of identifying and describing these benefits and services and changes in environmental quality and quantity affecting the availability of benefits and services. It is common to distinguish two ways of going about the task:

- *One-step approaches* supply descriptions of the different changes in environmental quality, usually with the aim of eliciting information on individuals' willingness to pay for improvements or to avoid deterioration. Here the primary difficulty is often with defining the changes (the good or harm) in question. The objects or systems often have many different functions. For example, with water, it is possible to link quality with biological, health or recreational possibilities — is it safe to drink, is it safe to bathe? — and to start with individuals' own estimations of water quality as a starting point. But ecological cycles may also be important. With issues such as biodiversity — involving, for example, the impact on bird populations of different levels of drainage in wetlands — providing valid yet understandable descriptions can become extremely difficult.
- *Two-step, or "Dose-Response" approaches,* by comparison, begin by asking "what caused the damage?" and develop a description in terms of causes and effects. Frequently, data from the physical and biological sciences are used to link a particular sort of pollution at different levels (the dose) with different levels of physical damage to human, animal and plant communities (the environment's response). Then, going further, a monetary value can be placed on the physical damage, thus furnishing a monetary valuation not just of the environmental damage (or benefit most) but also linked back to a given dose of pollutant.

The Dose-Response approach has the advantage of being a relatively systematic way of approaching the identification of changes in the environment caused by economic activities. But there is nonetheless always the possibility that important environmental functions beneficial to society go unnoticed and that some significant damage effects may be left out (for example, many pollution effects become noticeable only after quite some time).

Once benefit and damage categories have been decided, the question is how to attach a monetary figure to them. The most commonly used methods for quantifying environmental benefits from the "demand-side" are the Travel Cost Method, Hedonic Pricing, and Contingent Valuation Methods.

An example of detailed methodical application of the dose-response approach for placing monetary values on environmental damage is the *"ExternE"* study funded by the European Commission. This research, initiated at the beginning of the 1990s, aims at providing an operational accounting framework for monetary estimates of the externalities associated with the energy supply sector. Initial effort focussed on the coal and nuclear fuel cycles, and then oil and gas fuels, hydroelectricity, and wind power. A first round of methodological considerations and results was reported in six volumes (*EUR-1652 ExternE: Externalities of Energy,* vols.1-6, 1995). Extensions to further fuel types and implementation work for the 15 EC member nations are still ongoing.

- *The Travel-Cost Method* seeks to estimate a money value on the basis of the amount that people actually pay (in money and time) to gain access to beauty spots, wilderness and so forth, or to avoid various forms of damage and degradation. In effect, the costs that are incurred by visitors to a site are taken as a proxy to calculate the recreation value they place upon that site. This can be the basis for estimate of the significance (in money value terms) of damage or loss of availability of the site. There are typically three components to the "travel costs" that can be directly observed — the direct travel costs such as petrol costs, entrance fees where they exist, and the time-costs to the individuals understood as the opportunities that have been forgone in using their time to go to the site. The number of visits an individual will make to a site will be a function of how near and accessible the site is by road, the income of the respondents, the alternative sites available. The costs and relevant information are usually obtained from a questionnaire at the site. Statistical methods are used to plot the relationship between travel costs and the number of visits made to the site, from which it is possible to calculate an average value per visit. This is then employed to calculate a monetary value for the recreational value of the site.
- *Hedonic Pricing* correlates the environmental good or bad with some actual market item such as houses, so that variations in the price of houses from one locality to another can be correlated with the presence or absence of some desirable or undesirable environmental feature. e.g. a view. How much people are willing to pay is then supposed to reflect their preference for the environmental good in question, or their aversion to the bad. In effect, Hedonic Pricing Methods employ a proxy good in the market to estimate individuals willingness to pay for environmental goods and to avoid environmental damage. The most widely used proxy good is property: property values reflect a variety of different attributes, both non-environmental properties — such as room numbers and sizes, proximity to work and recreation — and environmental properties, such as noise levels from road and airports, the surrounding landscapes and so on. The differences in house prices where other factors are held constant give a revealed willingness-to-pay for the environmental benefits.
- *Contingent valuation methods (CVM)*, usually conducted through survey or interview of a sample of the interested population(s), present people with *hypothetical situations* (or, in some cases, simplified "laboratory" choices) designed to elicit statements about what they would be *willing to pay (WTP)* for preserving a specified environmental feature, or the *compensation that they would find acceptable (WTA)* in the case of its loss.

The travel-cost method and hedonic pricing are *revealed preference valuation techniques,* which involve deducing a money value on the basis of (a) observed time and money expenditures for goods in some complementary or substitute relation, and (b) underlying hypotheses about "optimising" behaviour. These are sometimes referred to as *indirect* methods. In the case of CVM, by contrast, the "worth" of environmental features is elicited *directly* through the questionnaire procedures.

Application of these sorts of "demand side" approaches received a strong boost by emergence of legal frameworks, notably in the United States, which have promoted CVM as a basis for deciding compensation for environmental damage due to industrial accident or waste spillage (see NOAA/Arrow et al. 1993). Results from application of such methods become components of environmental cost-benefit analysis, which in its most simple formulations aims at achieving the highest balance of benefits over costs for the project or policy selected (e.g., maximising net present value, or having marginal abatement cost equal to marginal benefit of pollution abatement).

Examples of Travel Cost and Hedonic Pricing valuation methods

TRAVEL COST METHOD FOR ESTIMATING BENEFITS: EXAMPLE OF FOREST RECREATION

Forestry management and policy making provides a good example of the problem of competing objectives: Forests are, at the same time, a source of timber, a habitat that sustains a variety of flora and fauna, an embodiment of cultural identity, an aesthetically significant landscape and a place of recreation. Several sorts of pollution can affect forest livelihood. In addition, the most cost-effective methods of timber extraction from forests often have an adverse effect on their landscape and recreational value; and conversely, management programmes to improve the mix and variety of timber may have costs in timber extraction.

In the U.K., the Forestry Commission has been under political pressure from the Treasury, the National Audit Office (NAO) and the Public Accounts Committee (PAC) to provide accounts of values to justify subsidies to forests. For example, the PAC in 1987 observed: "Generally... across many of the Commission's activities there was insufficient assurance on the extent and quantification of the benefits achieved or how far these were commensurate with the resources to achieve them." In response to this pressure, a study was undertaken of recreational visits to a selected forest park, as a way of obtaining some monetary measures of non-timber values that might justify the subsidies policy. The travel cost method was employed to attempt to attach a monetary value to the "recreational" uses of forest. Problems with effective application of the method in this case included the value to place on time; the problem of multiple visits; the phenomenon of the happy motorist whose enjoyment is derived from the travel rather than the visit; the method's bias toward travel by vehicles to estimate costs (in particular the private car); and the estimation of travel costs — whether this included petrol cost alone, or "full" costs including car depreciation, insurance and so on. In this study, a variety of rules of thumb led to ball-park figures that permitted the authors (Benson and Willis 1992, p.39) to conclude: *"The aggregate value calculated for non-priced recreation is £53 million at 1988 prices... The total is much larger that the estimate of £10 million quoted by the National Audit Office (1986)."*

(Source: J. Benson and K. Willis 1992 Valuing Informal Recreation Benefits on the Forestry Commission Estate London HMSO.)

HEDONIC PRICING FOR ESTIMATING ATTRIBUTE VALUE: DAMAGE FROM OPEN-CAST COAL MINING

Open cast coal mining is generally more profitable than deep mining. At the same time it is widely seen as the most environmentally damaging component, in terms of the visual impact, increased noise and traffic, dust during the operation and irreversible changes in the rural landscape it leaves afterwards. Thus for example, the profit for British Coal from the projected open cast mines in the Trent Valley, calculated at a discount rate of 8%, is £7.8m over the expected seven years of its operation. This represents an estimated £5.5 million greater profit than British Coal would receive from the production of coal in existing deep mined coal in the Trent Valley. However, these sums do not include external environmental costs of the operation.

Trigg and Duborg (1993) have reported an attempt to gauge the environmental costs by estimates of the fall in house prices in the local villages. Local estate agents were asked to consider, for four types of property, valued at £35,000, £65,000, £120,000 and £250,000, the predicted changes in property prices. *Table V* gives average predicted falls in prices for the affected villages, from the nearby Ball Green to the more distant villages of Knypersley and Brown Edge and Norton Green. The more expensive the properties, the greater the falls. Trigg and Duborg (1993, p.16) concluded that "'once the environmental costs opencasting are taken into account, the alternative deep-mined coal could be mined for roughly the same cost as opencast coal from the Trent Valley site. The result shows clearly that opencast coal-mining in the Trent Valley is no more economic than existing deep-mined capacity."

Note: This example actually uses a hybrid version of the hedonic pricing approach: it relies not on the actual behaviour of indivdiuals in the housing market in response to environmental damage caused by open cast mining, but rather expert estimates of what the likely response will be.

A.5. A SHORT NOTE ABOUT ESTIMATION PROBLEMS

A popular view amongst environmental economists is that it is (relatively) straightforward to make estimates of the economic costs of avoiding particular categories of damage or natural resource depletion; but it is much more speculative to obtain money estimates for the benefits of such action. In fact detailed empirical work on firm-level environmental expenditures and statistics-based sectoral estimations of abatement cost curves (e.g., in the GREENSTAMP project, see the papers collected in the *International Journal of Sustainable Development* IJSD Vol. No.2, 1998), suggests that cost-side information is very heterogeneous and often somewhat speculative, even for well-defined investment and technology choice situations. So robust "supply-side" valuation information is not as easy to come by as one might like to hope.

On the benefits side, it is generally agreed that there can be estimation difficulties. Some of these relate to "non-capture" of identifiable categories of benefits or damages in the valuation method (see paragraph 7 below). Others relate, however, to difficulties of the subject matter. The application of environmental cost-benefit valuation techniques involves the attempt to extend and transpose this traditional economic valuation methodology, together with underlying hypotheses about consumer preference formation, substitutability and opportunity cost estimation, and so on, into arenas for which it was not originally devised, namely: (i) extension spatially and materially to the complex non-produced and largely non-commodified "natural environment;" and (ii) extension temporally to the "long term" of ecological change and sustainability concerns.

That being said, when standard monetary valuation is attempted, the values of environmental goods and services are often separated into *use* and *non-use* values.

- Use values refer to those that are incurred from the actual use of environmental goods, for example, for recreation.
- Non-use values include, as general categories, the *option values* that express the preferences that individuals have for a good they might use; *bequest values* that signal preferences for preserving an environmental good for others including future generations; and finally, *existence values* that signal preferences individuals have for some good they may never actually or potentially use, for example the preservation of some species, ecosystem, habitat etc.

Taken all together these constitute the *total economic value* of the features in question (Pearce & Turner 90). The notion of total economic value can be valuable as a way of signalling the need to broaden the horizons of analysis. But robust quantitative estimates are elusive.

A.6. BRINGING TOGETHER SUPPLY-SIDE AND DEMAND-SIDE CONSIDERATIONS

An objective often put forward by economists for environmental cost benefit analysis is to *compare the costs of obtaining further environmental improvement (or avoiding further damage) with the benefits obtained.* The situation where the cost of reducing by one extra unit the environmental damage is equal to the value of the benefits obtained, is an *allocatively efficient (that is, "Pareto-optimal")* level of goods and damages production. This optimisation approach requires money estimates of the "marginal benefits" and the "marginal costs" of the environmental protection or enhancement action.

Quite apart from estimation difficulties (see §5 just above), it is important to note that cost and benefit considerations usually arise separately and are not automatically reconciled. In particular, in order to link cost-of-supply figures to "environmental value" as such, it would be necessary to introduce the proposition that the (marginal) cost of supply is equal to the (marginal) environmental benefit. Since this is not automatically true (and, indeed, will usually *not* be true in any real situation), it is important to assess to what extent and under what circumstances this proposition is likely to be approximately valid or can be considered as a policy reference point.

Let us note first that the ways that costs and benefits are identified, and the relative emphasis placed on "supply-side" and "demand-side" considerations for any particular problem, are closely related to the institutional and individual interests involved.

- For a community concerned about dieback of forest, the *environmental effect* is what matters, and this demand-side concern often leads back to a pointed search for the cause.

- For a company obliged to pay a tax or a fee relating to pollution emissions, the priority ordering is reversed. The primary concern is on the supply-side, namely with the *economic costs* of any obligation to "internalise" environmental damages. In order to keep these costs down there may be an inclination to dispute the seriousness of the damage or the strength of the cause-effect link.

The supply-side approach to the costing of environmental damage is based on looking at actual or prospective expenditures incurred in environmental protection or in abating or repairing damage, or for access to comparable amenities. We should, however, distinguish two sorts of reasons for such expenditures, corresponding to the two sorts of interests distinguished above:

- (i) There is an imposed obligation to pay, in relation to damages for which the party is in some way held responsible. In this case the paying party is *not* motivated by consideration of the environmental benefits to be obtained.
  Examples in this category are: compensation payments by firms in cases of industrial accidents causing health problems to workers and inhabitants of surrounding districts; expenditures for environmental maintenance or restoration by firms related specifically to the sites and ecologically disruptive effects of the industrial activity; and taxes or fees paid for pollution. These are expenditures that are not in the direct economic/welfare interests of those making the payments. Rather, they are imposed by an external authority — for example an ecotax or opllution emissions charge. If their imposition reflects a notion of direct responsibility for the damage, we may speak of application of the *"Polluter Pays Principle"*. (However, this principle may be implemented in a variety of ways, and more or less rigorously.)
- There is a benefit obtained directly by the person or agency taking the protection, abatement or repair action. In this case the paying party *is* directly motivated by consideration of the environmental benefits to be obtained.
  Examples in this category of "voluntary" payments are commercial investments in purification of polluted water to be used as an irrigation or manufacturing process input; or expenditures on medical treatment of respiratory complaints aggravated by city atmospheric pollution. The latter is a good example of environmental *defensive expenditures;* another case would be costs of double-glazing of home windows to reduce traffic or aircraft noise.

We can also note that in the latter sort of situation, while benefits obtained and payment (of supply costs) are linked, there still may be no link being made between causation of the damage and payment; indeed, in the examples given, the original damage was presumably caused by others. The presumption is that a benefit is obtained by the person or agency making the expenditure, yet it is clear that (other things equal) the affected parties would be better off if the water and air were non-polluted and there was no need to make such expenditures. Thus, these are de facto situations of *"Victim Pays."*

A.7. THE PROBLEMS OF NON-CAPTURE

In summary, the valuations of the environment obtainable through observation or inference of people's actual choices fall into three main categories:

- real costs incurred due to legally binding compensation or restoration obligations; or
- people's own "defensive" expenditures; and
- people's "revealed" preferences for obtaining specified environmental services or amenities.

To these should be added:

- people's "envisaged" or hypothetical preferences as elicited through contingent valuation, viz., willingness to pay or willingness to accept enquiries.

The above arguments and various examples show that monetary estimates of environmental benefits and damages suffered can have a clear policy-relevance in one way or another. But the "pricings" are not necessarily complete or "correct" in the sense of taking into account all environmental benefits and harms.

(a) On the supply side (I): Costs imposed. Many categories of investments and expenditures by firms, individuals, and public authorities are loosely justified by the need to "take the environment into account", but the level of investment or of compensation for damage is not specifically linked to any estimate of the environmental values involved. The absence of a clear link can be due to (a) estimation difficulties or indeterminacies and (b) the necessarily political and administrative character of such impositions (consider, in this light, the example of the Interim Damage Schedule proposal relating to marine oil spills, in Box). Legally binding provisions for compensation payments do not necessarily cover the "full costs" of the

damage as judged by the victims. There may, moreover, be long-term environmental damages for which no compensation is paid or payable, for example at Chernobyl or unnoticed toxic wastes.

(b) On the supply side (II): Costs actually incurred by choice. As already mentioned, actual expenditures made "voluntarily" and aimed to "supply" environmental goods and services — that is, investments and expenditures aimed to avoid environmental damage or to restore an environment that has been damaged — do not necessarily correspond closely to all the benefits that might be gained. This may come about either because the persons or society concerned do not perceive the benefits, or because they cannot "capture" the benefits and, as such, obtain a pay-back for their expenditures (In the example already given, the restoration benefits of forest replanting might be much greater than costs to a landowner, but captured by other persons over a long period of time.)

(c) On the demand side (I, II): Travel Cost and Hedonic Pricing. These methods capture preferences only insofar as they are "revealed" in or inferred from the behaviour of consumers in markets. Figures obtainable through both these sorts of analyses put a monetary value on the specified individuals' or agents' preferences for environmental goods and against damages, relative to other uses of *their own* time and money. These payments most often relate to tangible *use values* of the environment, over which the user has some power of choice. They cannot be expected to cover the value that might be attached to the feature or amenity by others or in the future.

(d) On the demand side (III): Contingent Valuations. The same remarks apply, generally, to the stated willingness to pay (or the demand for compensation) on the part of individuals for an environmental amenity or, for example, on the part of a commercial firm for access to (or the extra costs incurred in finding a suitable substitute supply of) a needed input or environmental service — such as timber, or volumes of water of a particular quality, or use of a river or sea as a receptacle for waste. Further, the absence of any real market for the goods or damages in question makes it is impossible to demonstrate that contingent valuation establishes "correct" prices, which leaves the figures obtained inevitably open to controversies (see paragraph A.8 below) .

THE "INTERIM DAMAGE SCHEDULE" AS AN EXAMPLE OF PROBLEMS OF NON-CAPTURE

As an example of the non-convergence of "supply-side" and "demand-side" considerations, take the example of a legally administrated instrument, the "interim damage schedule" as proposed recently in a United States context (Knetsch 1994). In much the same way that insurance companies define their monetary liability for different classes of personal injury, the suggestion is that government agencies could produce a schedule of "standard" damage assessment figures, for example covering a small number of "reference oil spills". Such a schedule would provide benchmarks to guide assessments of specific losses as they arise, without needing to calculate the fine detail of all possible resource or environmental losses. Its mode of operation would thereafter be akin to that of case law, the schedule being open to revision in the light of cases as they arise.

The schedule would thus set out monetary values serving an *administrative* need, in this instance, the definition of a "fair" compensation for damage incurred or a "fair" penalty for damage inflicted. Among the advantages claimed for the approach are speed and simplicity of implementation. There is no need for lengthy or complex inquiries to handle individual cases, since one might envisage a standing committee whose brief it is to keep a running watch on the schedule and propose modifications in the light of ongoing cases. The idea is that, on the one hand, the existence of such a schedule should act as a deterrent since there would be known "standard" penalties incurred for the causing of environmental damage and, on the other hand, the cost of damage to the party causing it would be relatively predictable, and therefore insurable. However, this sort of situation could mean that companies might actually be more ready to run the risk of inflicting environmental damage than now, as they would have contractual certainty that insurance companies will meet the legally defined costs of the damage and they could assume that the chances of being held liable beyond this level are low.

One obvious question is how the schedules would be decided upon, whose input would determine their content, and which bodies would have the responsibility for operating them? This brings out the fact that the schedule itself is only one component of a process of costing and managing environmental damage. For example, in order to decide figures in the schedule, should one use actual past clean up cost figures (which may not represent a "complete" environmental restoration or social compensation level), or contingent valuation procedures for estimating non-market benefits; or deliberative procedures? Equally important, what guarantees (if any) would be built in to ensure that, in the case of any real oil spill, a complete environmental "restoration" is achieved and compensation payments go to adversely affected persons? The criteria of administrative and legal workability (particularly important in the US cultural context) can, it is clear, be in conflict with any and all of economic efficiency, justice and ecological sustainability concerns. In practice, the bias of such an instrument could be to provide a predictable

operating environment (in the business sense) for industry, while not fully respecting the "precautionary principle" with regard to possibilities of severe irreversible spill-induced damages.

In the case of the Amoco-Cadiz Disaster on the Bretagne (France) coast, the question of "compensation" payments for damages and costs incurred in the clean-up period after the oil-spill was resolved only after protracted court hearings in the United States. Several claims against the tanker owners were dismissed wholly or in part by the judges. The costs/damages for which no compensation was paid include:

(1) Loss of monetary income to residents of the affected region, due particularly to reduction in tourist numbers compared with previous years and reasonable expectations.

(2) Unpaid labours of all sorts, including voluntary emergency clean-up work and also the long process of mopping up and adjustment of life back to "normal".

(3) Loss of amenity to the resident population of the region, due to the black tide, smells, expenditures on holiday trips to other destinations, etc.

(4) Damage to marine life and ecosystems, rejected on the basis that biomass is *"res nullius,"* that is, non- property. No compensation was paid, either, for reduced fish catches (or higher fishing costs), these being judged hypothetical....

The oil spill and its effects were, nonetheless, very real.

(Source: Bonnieux & Rainelli 1991)

A.8. SOME AMBIGUITIES ASSOCIATED WITH CONTINGENT VALUATION

Practitioners of contingent valuation, have, over the years, refined the approach and adapted it to a wide variety of situations. In doing so, they have themselves constructed a long catalogue of difficulties of implementation and obstacles in the way of effective use of the results in decisionmaking. Some of these difficulties relate to defining to "object" or service to be valued, others to the plausibility of respondent's value statements and the adequacy of the sample used.

In the absence of any real market for the goods or damages for which they are attempting to infer values, and given the speculative character of projections into the future, it is impossible to demonstrate that contingent valuation establishes "correct" prices, e.g., consistent with allocative efficiency and/or sustainability norms.

- One validation test is, when possible, to compare results from different elicitation procedures, to see if they converge on the same results. However, results from comparisons of CV, hedonic and travel-time measures are mixed, and in any case the validity of the comparison depends on the details of methods.
- Another form of validation is to concentrate on the internal consistency of the method. In part this involves trying to eliminate sources of ambiguity or "bias" that distort the discovery of the "correct" value for the good or amenity in question (biases frequently cited are listed in the Box below), and in part it involves trying to infer through statistical or sociological analyses the underlying meanings and determinants of people's responses.

SOURCES OF "BIAS" OFTEN CITED IN CV STUDIES

i. *Strategic and protest bids:* Individuals can understate their willingness to pay in the expectation that others will pay for the good which they will still be able to enjoy (free riders); they might overstate the amount they are willing to pay to try to make sure that the good is provided (strategic bidding); they might give a zero or very large bid because they do not accept the contingent valuation method itself (protest bidding).

ii. *Design effects:* The way a bid is elicited can affect the outcome. Various elicitation devices have been employed: bidding games in which respondents are asked if they would be willing to pay or receive a fixed amount, the starting bid, and then, depending on that initial response, asked for successively higher or lower amounts until a maximum is reached; open ended questions in which individuals are asked to state their maximum WTP or WTA; dichotomous choices in which individuals are asked WTP OR WTA responses for specific amounts which are varied across different respondents to achieve a spread of values; referenda, in which individuals are asked to vote for a change which is linked to choice of a WTP value. Different elicitation formats will produce different results.

iii. *Presentation and information effects:* Changes in the quantity and quality of information presented about an environmental good and the form in which one presents it, including for example visual presentations, will also alter responses in willingness to pay surveys about environmental goods. Generally the better the information and its presentation the higher the bid.

iv. *Payment vehicle biases:* The vehicle used to elicit bids in a CVM can affect the WTP value. The popularity or unpopularity of taxes has a strong influence on WTP bids, while WTP into a private trust fund can be affected by the perceived trustworthiness of the fund.

iv. *Embedding and part/whole effects:* Respondents to WTP surveys are apt to bid almost the same for the preservation of watering sites for 2000 migratory birds as they would for 200,000, (Desvouges et. al. 1993) or to clean lakes in one part of a region as they would for the whole region (Kahneman and Knetsch, 1992). Similar "embedding" effects can be arrived at by altering the payment periods for the goods in question.

v. *Ordering effects:* The order in which options are presented to the individual can affect the payments.

vi. *Framing effects:* The way options are framed can change the response.

vii. *Compliance bias:* Individuals may respond in order to try to please the interviewer.

Academic debates continue about theoretical foundations for different CV questionnaire designs and interpretations. Equally significant have been efforts with the more pragmatic intention of arriving at values that are acceptable for policy makers. Particularly influential have been the recommendations of the NOAA panel of economists in the USA (NOAA 1993), where the question arose (among others) of the role of CV estimations for defining compensation for damages such as the 1989 *Exxon-Valdez* oil tanker wreck in Alaska. The approach adopted by NOAA was generally conservative, in the sense of advocating those procedures which tend to produce modest environmental damage valuations. This included recommendations to eliminate "extreme" responses, and to prefer WTP formats over WTA formats since the latter generally resulted in higher values, sometimes much much higher. Other recommendations included attention to the importance of accurate description of policies or programmes and information about alternative undamaged "substitute" sites available and the opportunity costs involved, follow-up questions to discover reasons for apparently discrepant replies to WTP questions, procedures for the elimination of "illegitimate" bids, and so on.

The questions of "bias" or "illegitimate" responses are not simple to resolve. There are several sources of possible divergence inherent within the CVM itself. In particular, it seems likely *a priori* that there will often be discrepancies between expressed *willingness to pay* for an environmental good and *willingness to accept* (the minimum acceptable compensation for loss of the good or of access).

There are well-documented cases of individuals in real market situations with property rights who refuse to part with a good whatever the price offered, or would refuse compensation to accept some damage to their health or well-being. Similarly, figures obtained in environmental CV studies for compensation that would be demanded are often several times higher than for willingness to pay. Several plausible explanations can be offered. These include:

- the lack of budgetary constraints on the willingness to accept estimates,
- the fact that individuals are often loss-averse,
- the possibility that they are responding in some way on the basis of ethical convictions or "on behalf of" a larger community (so-called option, heritage, and existence values).

Such divergences show that the distribution of property rights and also people's own views about the "rights and wrongs" of proposed policies or resource uses can affect the estimation of values. Interpretation of responses is further complicated by the diversity of respondants' views on rights and legitimate interests. Individuals are often reluctant to pay if they believe that they have, or should have, rights to the goods. In particular, where environmental damage is being done to a good that a person feels they have a right to, then moral appeal is often made to the "polluter pays" principle.

In the U.K. Pevensey Levels study reported by J. Burgess, many members of the public expressed strong views about their "rights" to enjoy the countryside. Contrasting views were expressed by farmers, for example one comment on townspeople visiting the countryside to the effect that *"they don't realise that we own the land. They think its national heritage and they can go where they like"*.

The issue of willingness to pay is caught up in a much larger social issue of competing views of rights to the countryside and who has rights to expect compensation for producing an environmental good and who has the duty to pay. These sorts of issues become particularly important when addressing longer-term problems linked to economic and environmental sustainability — in this context the scientific and economic uncertainties, the conflicts of principle in society, and the conflicts of interest across different sectors and socio-economic groups can all become very large.