Natura economica in Environmental Valuation

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ABSTRACT

Cost-benefit analysis is widely acknowledged to be an appropriate tool for providing advice to policy makers on the optimal use and management of natural resources. However, a great deal of research has indicated that the assumptions made in cost-benefit analysis concerning the natural environment diverge from real world observations. In this paper I discuss these observed divergences. To do so, I introduce the concept of *Natura economica*. *Natura economica* is the environment as it is understood in economic analysis in general, and cost-benefit analysis in particular, namely as a bundle of commodities with potential market value. I argue that if this understanding of nature and its value is very different from what is generally observed, it reduces the value of the resulting policy recommendations. I then suggest four questions that policy makers should ask when they evaluate their choice of appraisal methods. If the answer is 'yes' to all of them, then cost-benefit analysis can provide valid information. However, if the answer to any of these questions is 'no', other methods, such as multicriteria analysis and participatory processes, should be considered in order to arrive at better-founded policy recommendations.

KEY WORDS

Cost-benefit analysis, policy-making, environment, ethics

1. INRODUCTION

Cost-benefit analysis aims at securing efficiency in the allocation of goods. In such analysis it is necessary to assume that, for example, environmental goods are commensurable in order to be able to optimise a specific environmental management problem. Those who apply cost-benefit analysis for environmental decision-making therefore have a certain understanding of nature that sometimes

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differs from that found among other research groups. Hence, assumptions about the environment in cost-benefit analysis have been questioned in a great deal of ongoing research.

In this paper I introduce the concept of *Natura economica*, which refers to the environment as it is defined and understood in cost-benefit analysis. In cost-benefit analysis, nature (or natural goods) is (are) generally understood to be a bundle of commodities that can be assigned monetary value in a shadow market. Typically, the value is found by asking individuals for their stated preferences in terms of their willingness to pay for conserving natural goods. A total environmental value is then found by aggregating these preference values for all affected individuals. The concept of *Natura economica* refers to this entire packet of assumptions and way of looking at nature.

In order to find the market value of the commodities that are comprised in *Natura economica*, individuals give their stated preference values in terms of their willingness to pay. These individuals are assumed to behave as *Homo economicus*, a well-known concept which represents the individual in all neo-classical economic analysis. *Homo economicus* has purely individual consumer interests, wants to maximise individual utility, and is characterised by individual rationality. As *Homo economicus* alone attributes market value to *Natura economica*, there is an important link between *Homo economicus* and *Natura economica*.

Many psychologists argue that the behaviour of *Homo economicus* differs from real people's behaviour (Thaler 2000; Rabin 1998; Kahneman et al. 1990). Further, many scientists within the fields of ecological and institutional economics indicate that the environment assumed in cost-benefit analysis diverges from nature as it is observed in the real world (including Vatn 2003; O'Neill 2001; Norton and Steinmann 2001; O'Connor 2000; Tacconi 2000; Norton et al. 1998; O'Neill 1993; Tayler 1990).

The goal of this paper is to address the main differences between *Natura economica*, representing natural goods the way they are defined in cost-benefit analyses, and other views on how the environment can be understood. Because the economic value of the natural environment is found by asking individuals for their preferences, I also introduce some of the well-known discrepancies between *Homo economicus* and *Homo sapiens*. I argue that if the characteristics of both natural goods (*Natura economica*) and the behaviour of people (*Homo economicus*) are understood very differently in cost-benefit analysis from the way in which they are observed in the real world, the final policy recommendations resulting from this analysis must be said to have reduced value in environmental decision-making processes. Moreover, cost-benefit analysis has a single goal: that of securing efficient allocation of goods. Yet for sustainable development it is often recommended that more goals should be incorporated in the analysis, including ecological, social and economic ones. I recommend that four questions be asked to find out whether other techniques can contribute more valid information. These questions concern the aforementioned divergences between

assumptions made about natural goods and human behaviour in cost-benefit analysis and real world observations. If these differences are large, alternative methods such as multicriteria analysis and participatory processes with stakeholders and citizens are recommended.

The paper is organised as follows. Section 2 presents *Natura economica* and addresses discrepancies found between it and other views on how nature and its value can be understood. In section 3 I introduce *Homo economicus* and discuss the differences found between *Homo economicus* and *Homo sapiens*. Section 4 presents the main goals which should be incorporated into sustainable development analysis, and in section 5 I present some important alternatives to cost-benefit analysis. Section 6 gives recommendations for how to choose between different methods for environmental policy making, and section 7 presents the conclusion.

2. *NATURA ECONOMICA*

Two of the most important assumptions made about *Natura economica* are: 1) that it can be treated as a bundle of commodities and 2) that it has a total environmental value (TEV). I here present discrepancies between each of these assumptions and ways of understanding nature and its value that are found in other ongoing research.

2.1. Nature can be treated as a bundle of commodities

The main characteristic of *Natura economica* is that the environment can be understood as a bundle of commodities, or natural goods, that can be traded in a market. So, what constitutes a commodity? A commodity is an object (or service) produced for exchange and sale. The interdependent elements of the environment, or ecological services, are valued, not the biodiversity per se (Turner et al. 2003). In order to be able to sell the commodity, its ownership arrangements must be agreed upon. Ownership is a set of rights; right to possess, to use and to manage. Hence, the ownership to a commodity gives the right to trade. This implies that there is a need to implement a system of exchange values, i.e. prices. It also implies that there is a need for physical demarcation of various resources (Vatn 2000).

Vatn (2000) raises two problems regarding the treatment of nature as a commodity: 1) the problem of defining the boundary of environmental goods, and 2) the ethical issues related to trading the environment.

First, regarding the issue of setting boundaries on nature, it can be argued that in contrast to the characteristics of commodities as defined in the cost-benefit approach, nature can be seen as a system. This system of energy and matter is characterised by a number of processes and feedback mechanisms that maintain

its internal and external balance. It can be argued that such a system cannot be fragmented, allocated to an owner and given a market price. The system is too complex and the interactive processes too vulnerable. Placing a boundary around many environmental entities for the purpose of defining property rights over them is difficult or even impossible (O'Neill and Spash 2000). Even if we managed to allocate ownership for each molecule, we would still not be able to capture the relational aspects of the processes (Vatn 2000).

As a consequence, two related technical difficulties frequently show up in surveys on environmental valuation of nature, generally referred to as: 'the complex good problem' (Clark et al. 2000; Green 1997) and 'inadequate information' (Burney 2000). 'The complex good problem' implies that people are not used to paying for the environment in the same way as they would pay for a commodity. Nature with all its interconnected relationships makes people feel that they cannot, as individuals, set a price on the fragments. People also think that responsibility for the management of the environment belongs to society, not to individuals. 'Inadequate information' refers to the fact that people may not value nature as highly as they would if they had sufficient information about the complexity of nature.

Second, regarding the ethical problem mentioned by Vatn (2000), some potential 'goods' are blocked from being exchanged in markets for social and moral reasons. Refusals to trade are sometimes based on the fact that non-human entities are taken to have some ethical standing (Vadnjal and O'Connor 1994; O'Neill and Spash 2000). This is related to the understanding of nature as a system. For example, extracting animals or plants from their natural habitats can be seen as morally unjust, bringing with it the risk of losing a large part of the value they would have as part of a complex biodiversity. In addition, since animals in an environmental context are not 'consumed' in the way most other market goods are, it just seems wrong to treat them as commodities. In a similar way, it is seen as morally unreasonable to treat bodily organs, or friendship, as commodities (O'Neill and Spash 2000). Nor can heritage, meant for future generations, be substituted for monetary value now (Burgess et al. 1995). The environment is composed of objects of moral concern and thus constitutes more than just an economic resource (O'Neill and Spash 2000).

2.2. A total environmental value (TEV) can be found to value nature

The understanding of *Natura economica* as a bundle of commodities implies that economic values can be attached to natural goods. In cost-benefit analysis, both total costs and total benefits must be found when policy decisions are to be made on future use and management of the environment. The total environmental value (TEV) can be found by simply aggregating different values across all of the affected individuals. Pearce (1993: 22) specifies that TEV can be found by aggregating different environmental values, such as:

- *direct use value* (UV): refers to actual or planned use of the service by an individual, for example, for recreation (Pearce 1993);
- *indirect use value* (IUV): refers to the ecologist's concept of 'ecological functions'. An ecosystem function is defined as 'the capacity of the environment to provide goods and services that satisfy human needs directly or indirectly' (De Groot 1992: 13; De Groot et al. 2002: 394);
- *option value* (OV): relates to the willingness to pay (WTP) to guarantee the availability of the service for future use by individuals (Pearce 1993);
- *existence value* (EV): (=intrinsic value (Pearce and Turner 1990: 131)) refers to the knowledge of individuals that the service exists and will continue to exist independently of any form of uses;
- *quasi-option value* (QOV): refers to WTP to avoid an irreversible commitment now, given the expected future growth in knowledge relevant to its implications (Pearce and Turner 1990: 133).

If a project is to be implemented in a nature area, the TEV of this area must be found in order to know whether it is recommended to implement the project or not. This is done by simply aggregating these five sorts of values across all of the affected individuals (TEV=UV+IUV+OV+EV+QOV).

Further, in cost-benefit analysis, the project should go ahead if net present value (NPV) is higher than zero. That is: $NPV = \sum_t [B_t - (C_t + TEV_t)]/(1+r)^t$, where B_t is total benefits at time (t) of implementing the project, C_t is the total costs at time (t) of implementing the project, TEV_t is the cost associated with loss in the environment at time (t) and r is the discount rate (Turner et al. 1994).

Finding of TEVs for natural areas implies that the different values can be measured and compared on a cardinal (i.e. monetary) scale. They are commensurable. In evaluating objects, value commensurability entails a measure of value (e.g. monetary value) attached to the objects evaluated so that they can be uniquely ranked (O'Neill 1993). O'Neill (1993) specifies that commensurability can take weak or strong forms depending upon whether one takes the measure to have a cardinal or ordinal interpretation. Furthermore, it is possible to distinguish between the concepts of strong commensurability (common measure of the different consequences of an action based on cardinal scale of measurement), weak commensurability (common measure based on ordinal scale of measurement), strong comparability (there exists a single comparative term by which all different actions can be ranked) and weak comparability (one has to accept the existence of conflicts between all different consequences of an action). Comparability is a necessary, but not sufficient, condition for commensurability (Aldred 2002). Thus, cost-benefit analysis assumes strong commensurability and a single measure of value through which one can arrive at a unique ranking of the value of different policy options (Munda 1997).

Alternatively, a scale can be ordinal, implying that only the sign of the net benefit measure has any significance and not its magnitude. The use of the two possible scales can result in different policy recommendations (Aldred 2002).

Many researchers have indicated that it is not possible to assume commensurability of natural goods (Vatn 2003; Aldred 2002; Munda 1997; O'Neill 1993). They argue that values are influenced by how the natural goods are defined, and often they attach plural values to nature. Satterfield (2001) searched for different environmental value categories frequently mentioned in the literature that can be argued to be incommensurable. Some of them can be categorised in the ecological function approach (De Groot 1992). They include:

- Ecological sustainability: refers to the sustainable maintenance over time of a resource and to the general principle of valuing development, act, use or impacts.
- Spiritual value: refers to nature as a source of inspiration for religious and spiritual thoughts.
- Aesthetic value: refers to valuing nature for its aesthetic qualities, which are most often referred to as beauty. Further, beauty can be related to age. It has taken hundreds of years to create a nature area that has high biodiversity and complex systems.
- Recreational value: is typically constructed as a use value and includes, for example, nature as a means of relaxation or as a route to learning.
- Life support value: is among what economists refer to as natural capital and ecologists refer to as ecosystem services.
- Intellectual and scientific value: refers to the value of human intelligence and creativity.

Other environmental values are more difficult to categorise on the ecological function approach, firstly, because these values are further away from the traditional human preference approach and second, because full information is not available. Common for these values is that a reference point is set from 'nature's point of view'. These values are also argued to be incommensurable and they include (Satterfield 2001):

- Historical and temporal evolution value: refers to positive valuation of biotic life.
- Recovery value: refers to the recuperative powers of nature.
- Complexity value: refers to valuing nature for the intricate processes and systems that are within it.
- Healthy environment value: refers to the rights of future generations to a healthy environment.

- Resilience of ecosystems: refers to the capacity of an ecosystem to undergo disturbance and maintain its functions and controls (Satterfield 2001; Gundersen and Holling 2001).
- Rights/equity values: refers to the concept of rights, which historically was applied solely to human groups as an expression of entitlement to treatment of a particular quality. An ongoing debate among philosophers concerns the rights of nature. Of those who believe that nature has rights, some hold that it is necessary to achieve a balance between the rights humans have and those that nature has. Others believe that the rights of nature should take priority over human rights, whereas others again argue the reverse.

Consequently, many people refuse to assume value commensurability, and cardinal scale with a monetary value, as this simply ignores the plurality of value dimensions mentioned above (O'Neill and Spash 2000). Hence, natural goods can be said to be incommensurable and even incomparable: they cannot be aggregated if all nature's value dimensions are to be included in the analysis. This implies that the TEV found in cost-benefit analysis covers only a very small part of the total value, since only a single monetary value is used.

Some people stress the importance of the reasons and values that lie behind preferences. In other words, for them, the strengths and weaknesses of the arguments are more important to capture than the intensity of the preferences (O'Neill and Spash 2000). For example, environmental goods, such as biodiversity, can be grounded in aesthetic, scientific and communitarian judgments, which are understood as *reasons for preferences* and not as preferences estimated in a cost-benefit analysis. This argumentation appeals to *deontological ethics*, which emphasises the importance of doing what is considered right.

With the above reasoning in mind, it can be argued that natural resources should be treated as shared goods (Tayler 1990) in which people have a common interest and for which they share responsibility; rather than as convergent goods, in which people have only individual consumer interests.

3. *HOMO ECONOMICUS*

Actors in a market situation set a value on *Natura economica*. Such an actor is described as *Homo economicus*, exhibiting the characteristic human behaviour assumed in neo-classical economic theory, including utility maximisation. As utility maximisers, their preferences are assumed to be 'complete', 'transitive' and 'continuous' (Hausman 1992). 'Complete' refers to individuals' capacity to rank all goods or bundles of goods (for all x and y, x>y or y>x). 'Transitive' refers to individuals' capacity to rank in such a way that if x is better than y and y is better than z, then x must be better than z. 'Continuous' refers to consumers' ability to distinguish between goods, even if the difference in utility is infinitely

small. The latter occurs when x is preferred to y, and z is sufficiently close to y, so that x is also preferred to z.

When conducting a cost-benefit analysis, people are typically asked for their WTP for their satisfaction with an environmental good, given budget constraints and assignments of probabilities to different possibilities. Thus, the WTP gives the strength of people's preferences, which are assumed to have the characteristics of individual utility maximisation.

However, experiments within the field of behavioural (experimental[1]) economics show that divergences from the assumptions made about preferences are plentiful. (Thaler 2000; Loomes 1999; McFadden 1999; Rabin 1998; Kahneman and Knetsch 1992). Behavioural economists typically confront the assumptions of economic theory with psychological knowledge. Psychology systematically explores human judgment, behaviour and well-being, and can therefore teach us a great deal about human behaviour (Rabin 1998). All the characteristics of *Homo sapiens* that differ from the assumed *Homo economicus* can influence final WTP estimates for an environmental good.

In a wide variety of domains, people are more averse to losses than they are attracted to the same sized gains (Rabin 1998; Kahneman et al. 1990). This loss aversion is related to the endowment effect, namely that once a person comes to possess a good, she/he immediately values it more than before. In other words, it is more costly to give away something that you have (willingness to accept in compensation; WTA) than to pay for something that you do not have (willingness to pay; WTP).

Knetsch (2000) illustrates that divergences occur related to this gain and loss perspective, and that not two, but a total of at least four different values can be found for a single good, depending on whether the entitlement is being gained or lost. Hence, the value will differ for WTA and WTP, but also in situations where people can, on the one hand, choose between gaining money or an entitlement, or, on the other hand, between losing money or an entitlement. In addition, people's valuations of entitlements vary because of differences in time and context.

Within behavioural economics the differences between *Homo economicus* and *Homo sapiens* are often referred to as 'effects' or 'biases', as economic theory is used as a benchmark to see how individual behaviour differs from assumed behaviour. Thaler (2000) mentions four characteristics of *Homo sapiens* that can influence their WTP in regard to forecasts about the future. They are: 1) individuals tend to be unreasonably optimistic about the future; 2) individuals believe that they are better forecasters than they are; 3) individuals tend to think that others are just like them; and 4) once individuals are convinced that their strategy is right, it is difficult to convince them of the opposite (i.e. anchoring effect). Moreover, people are more sensitive to changes than to absolute levels, as determined by factors such as past consumption or expectations about future consumption. (i.e. reference point bias) (Rabin 1998; Darley and Gross 1983).

Also, two logically equivalent statements of a problem can result in different choices. For example, people react differently to offers depending upon whether the lower price is called a discount or the higher price a surcharge (i.e. framing effects) (Tversky and Kahneman 1971). In some cases when people are confronted with certain pairs of options with roughly the same expected value, they often choose one pair over the other, but price the other more highly (i.e. preference reversal) (List 1992). Again, individuals prefer the status quo to changes that involve loss of some goods, even when these losses are offset by gain of other goods (i.e. status quo effects) (Knetsch 1989).

In general, responses rely too heavily on readily retrieved information, and too little on background information (i.e. availability effects) (McFadden 1999). In reality, preferences depart from pure self-interest: people often sacrifice money in retaliation against unfair treatment (i.e. social goal effects); or if somebody is being nice (mean) to you or others, you are inclined to be nice (mean) to him (i.e. reciprocity effect). If a new irrelevant alternative is added to a choice set, the choices for one of the relevant alternatives are shown to increase (i.e. context effects). (Simonsen and Tversky 1992).

The effects and biases referred to above indicate that individuals' preferences are not complete, transitive and continuous, as assumed in neo-classical economic theory. Nor are they purely individual but are, in fact, influenced by many social factors. Classical institutional economists, for instance, argue that preferences, and WTP, are institutionally defined or dependent. Here, the main question concerns the finding of an appropriate mean, or method, rather than uncritically finding the WTP without understanding the context in which it is found. Vatn (2003) gives some examples of characteristics of institutional arrangements concerning the different contexts involved and their related roles. For instance, in a market people may behave as consumers with preference characteristics of utility maximisation, individuality and exchange. But in a different institutional system, such as a firm, people's roles as employers or employees are characterised by preferences for profit maximisation and command. In a family, parents and children want and expect from one another care and involvement, whilst in the political arena people play the roles of politicians, voters and citizens, who want to balance interests, protect their interests and argue for their views.

In addition, Etzioni (1988) insists that individuals' preferences depend on the social sphere. People may co-operate even though it will reduce their individual utility to do so. Even in the market place people need to have confidence and trust if they are to maximise their utility. And trust is itself a social construction.

Etzioni (1988) also states that people's behaviour is founded in moral reasoning about what is the right thing to do, and thus there is always a tension between moral reasoning and individual utility maximisation. Moral motivation can, for example, result in the refusal to assign a WTP to a natural good. Further, Cal-

licot (1984) argues that value in nature is grounded in human feelings. Similarly, Ariansen (1998) distinguishes between utility maximisation and emotions.

Tacconi (2000) shows theoretically how environmental decision-making must be seen in the context of expanded human behavioural space (see Figure 1). This three dimensional behavioural space reflects, as well as maximisation of individual utility, behaviour that responds to affective, moral and social values (behavioural modes), self-regarding as well as other-regarding behaviour (morality) and individuals as well as collective decisions (aggregation level). This reduces self-interested individual behaviour that maximises utility to merely one point within the whole behavioural space. If nature is understood as a shared good, the behavioural space is likely to be one where society, normative values and other-regarding morality have high values in the figure.

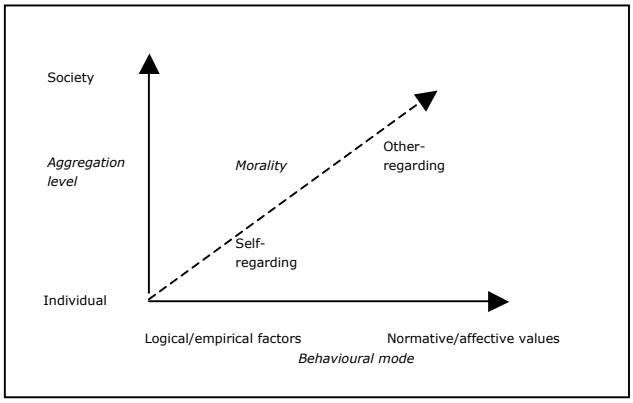

FIGURE 1. Expanding Behavioural Space (Sources: Stagl 2003; Tacconi 2000; 1997)

In addition to all these influences on preferences and behaviour that can occur at particular times, it is argued that preferences change over time as a result of cultural influence on attitudes, and increased levels of knowledge resulting from more information. Such influence occurs, for example, through education, advertising and the media. (Norton et al. 1998).

If the behaviour of real people differs from the behaviour of *Homo economicus* in all these respects – because of psychological factors, social factors and influences over time – it can be argued that an aggregate of the preferences of all affected individuals cannot give a reliable total environmental value on natural goods. Thus, in addition to finding it difficult to aggregate the different environmental values because they are incommensurable, it can be difficult to

aggregate the affected individuals' stated preferences. Thus behavioural economists as well as institutional and ecological economists argue that the outcome of the cost-benefit analysis can lead to wrong predictions and hence wrong policy decisions about the management of nature.

4. MULTIPLE GOALS IN SUSTAINABLE DEVELOPMENT

Cost-benefit analysis assumes that the main policy goal is to manage environmental resources as effectively as possible over time. It has largely ignored other goals for a society because they tend to be 'costly' or 'subjective'. However, sustainable development includes both economic and ecological system sustainability (Faucheux and O'Connor 1998). This implies that emphasis must be moved away from expansion of the vector of produced commodities (such as measured in aggregate by GNP-growth) to a wider view that includes qualitative improvements in living conditions and the maintenance of our biosphere life support systems and other ecological functions. It has been argued that sustainability can be combined with economic efficiency, since there is a potentially infinite number of time paths for resource use and nature conservation that might satisfy the goal of economic efficiency (Norton et al. 1998).

Moreover, sustainable development implies both inter- and intra-generational equity. At the centre of environmental conflicts are arguments about justice and fairness in the distribution of environmental goods and harms. In many instances it is more important to people that the welfare is shared than that it is maximised. (O'Neill and Spash 2000). Thus, it is frequently argued that emphasis should be put on three goals: 1) ecological sustainability, 2) fair distribution and 3) allocative efficiency (Norton et al. 1998).

It has also been argued that the incorporation of multiple goals in environmental policy analysis leads to non-objectivity because ecological and social aspects depend upon subjective considerations. This is often said to support the use of cost-benefit analysis, since it has been argued that it can provide objective information. For example, Pearce (1993: 13) argues that the use of money as a measure of environmental value is a necessary condition for economic objectivity in cost-benefit analysis, because expressing values in monetary terms allows for comparison of different component parts of the total economic value. De Blonde (2000) concludes that the objectivity of cost-benefit analysis has four components: 1) empirical testability of the data, 2) logical consistency, 3) empirical relevance of its assumptions and 4) mathematical exactness of its calculations.

However, looking carefully at these four components, it is not possible to argue that they are objective, because they are all based on value ideas (De Blonde 2000). These value ideas have defined all the basic components in the cost-benefit analysis, including human behaviour and natural goods as discussed in this paper. Hence, cost-benefit analysis relies on factual common consent.

This common consent consists partly in the logical consistency, mathematical rigour and empirical testability of economics and partly in agreement about the value ideas that constitute human behaviour and analytical instruments. Hence, it is not generally acknowledged outside the community of cost-benefit analysts that their tool has the capacity to give objective policy recommendations on the value of nature.

5. ALTERNATIVE METHODS

Because of the comprehensive criticism found in recent literature of the assumptions of cost-benefit analysis, the following questions are of high relevance. When should environmental policy makers make use of advice from cost-benefit analysis? Can other methods contribute more valid information?

Obviously, the cost-benefit approach is supported by many highly respected researchers. Among the arguments put forward in defence of cost-benefit analysis is the fact that all models must simplify reality in order to stay focused on the issues being studied. Thus, it can be a strength to consider only the interdependent elements of the environment, if the relevant environmental aspect of the study is understood only as, for example, soil or pollution, even though an aggregate of all environmental functions may not be equivalent to the total system value (Turner et al. 2003).

In this paper, I do not argue that the cost-benefit approach always leads to wrong policy recommendations; instead I offer advice to policy makers on how they can approach the results provided by such analysis. Alternative methods with different assumptions that are recommended in certain circumstances include multicriteria analysis (MCA), (Beinat and Nijkamp 1998; Munda 1995; Saaty 1994; Janssen 1992; Vinke 1992; Vogd 1984), participatory methods such as stakeholder participation (Bulkeley and Mol 2003), and deliberative processes (Smith 2003; O'Neill 2001; Clark et al. 1998).

One of the main advantages with MCA techniques is that they can incorporate a range of different goals and value dimensions in the analysis, such that natural goods do not necessarily need to be treated as commodities with a monetary value. The different MCA techniques (REGIME, EVAMIX, ELECTRE, PROMETHEE, NAIADE, and AHP) relate to certain algorithms, ways of processing data and presenting results. Types of algorithms include weighted summation (i.e. in trade-off utility modelling), concordance and discordance analysis (i.e. in outranking modelling) and minimisation or maximisation (i.e. in goal programming). One main issue to be considered when selecting an appropriate MCA technique is the choice of a preference measurement scale. This is applied when conducting interviews to identify peoples' preferences. Relevant preference measurement scales include pair wise comparison, complete ranking, partial ranking and rating (see Vogd 1982: 102–5). The responses from

stakeholders; individuals or groups, or from citizens, can then be analysed to find which views on the value of nature gain most support.

In cases where respondents lack general information about the issue, participatory processes should be considered in a pre-phase to the MCA. This is also recommended because MCA techniques usually assume that detailed information is already provided in the analysis, whereas participatory approaches make provision for the gathering of this initial information.

In the participatory processes natural goods can easily be treated as shared goods with normative values and societal perspectives. The main advantages with these techniques are that they can tackle incommensurable environmental values, and that the aggregation of peoples' preferences, priorities and wants is not required. In stakeholder participation processes individuals represent their own or group interests, whereas in deliberative processes people are asked to perform as citizens and are expected to give arguments from a society's point of view. Another difference between the two techniques is that stakeholder participation takes place with no input from experts or others that might influence participants' answers, whereas deliberative processes aim to reach an agreement after a process of reasoned dialogue between participants. Often experts are invited to the deliberative meetings to provide additional information. Moreover, participants are required to have respect for every other person, to have an open dialogue based on reasons and to allow for the development of empathy and imagination to play a role in trying to get to an agreement (Smith 2003). However, because deliberative democracy is criticised for still being theoretical and speculative (Smith 2003), and for not resulting in agreement among participants when being applied in praxis, it can be useful to combine the deliberative processes with some of the MCA techniques. If an MCA technique is used in combination with a participatory process, incommensurable environmental values can be handled in the analysis (Munda 2004). MCA assists in structuring the process, explores similarities and differences in peoples' evaluations, and helps in transparent representation of the problem which can easily be communicated to others (Stagl 2003). However, it might be a problem to gather an overview of the specific characteristics of the variety of available MCA techniques when choosing a method. Moreover, it might also be problematic that there is no correct answer to what properties of the MCAs are considered 'right' and 'wrong'.

6. POLICY IMPLICATIONS

As an indication of which situations could be suitable for applying cost-benefit analysis, and in which situations other methods like the MCA, stakeholder participation and/or deliberative processes can contribute with more valid information, I shall briefly introduce a management example and continue by asking four questions regarding the specific situation.

In the example, I suggest that managers are asked to implement policy strategies with the main goal of sustaining a viable fishery sector in a developing country (see Soma 2003). This situation is characterised by poverty within the fishery communities, threats to a diverse marine ecosystem and profitable economic opportunities, including intensive fishing and increased access to a foreign oil industry. In this scenario, suitable policy options for the fishing sector will not necessarily consider ethical aspects such as poverty reduction, the importance of ecosystem diversity, or the impacts of a foreign oil industry. However, if the reality is theoretically simplified by considering only the economic dimensions, the analyst must hope that the ethical issues will be handled by others, for example, by policy makers. The analyst could instead choose also to consider the ethical dimensions by letting stakeholders and/or citizens contribute their values and 'real world observations' in a participatory process. Note that theoretical biases can also occur in participatory processes when participants base their 'real world observations' on incorrect facts about the environment because they are wrongly informed.

What method should be applied to prepare for final policy strategies? A 'correct' answer to this question will be hard to find, but, depending upon what purposes the policymaker has in mind, a choice must be made as to what simplifications of reality are acceptable. In order to encourage policy makers to be aware of the simplifications that are made in the relevant decision support tools, I recommend that, in any particular management situation, policy makers should ask the following questions:

1. Is it sufficient to set only one main goal in the analysis?
2. Can the environment be treated as a bundle of commodities?
3. Are nature values commensurable?
4. Can the affected individuals' preferences be aggregated?

Recommended techniques to be used in environmental policy-making processes when answering these questions by YES or NO are briefly provided in Table 1.

In the table we can see that if the policy makers accept the theoretical simplifications typically set in a cost-benefit analysis, the answer is YES to all the four questions. In such a case, cost-benefit analysis, as well as most MCA techniques, has the potential to provide policy makers with valid recommendations. This is because these techniques can identify a single goal, treat natural goods as commodities with cardinal scale for comparison and make use of the individual preference approach as a basis for their analysis. As illustrated in the management example above, answering YES to the four questions implies that it is seen as responsible to exclude ethical issues regarding, for example, poverty and biodiversity, from the analysis.

TABLE 1. Methods to support environmental policy decisions

Questions	**Answer: YES**	**Answer: NO**
1) Is it sufficient to set only one main goal in the analysis?	*Acceptance for policy recommendations*. The CBA as well as most MCA techniques can give valid policy recommendations.	*Rejection of policy recommendations*. Several MCA techniques (e.g. REGIME, EVAMIX, ELECTRE, PROMETHEE, NAIADE, AHP) can incorporate many goals including ecological sustainability and fair distribution as well as effective allocation. Also a deliberative process can be applied in this case to cover multiple policy goals.
2) Can the environment be treated as a bundle of commodities?	*Natura economica is accepted*. The CBA as well as most MCA techniques can give valid policy recommendations.	*Natura economica is rejected*. Deliberative processes, or stakeholder group participation processes, can provide more valid information by finding arguments on how nature can be understood. Analysis by an appropriate MCA technique can take place in a second step (e.g. REGIME, EVAMIX, ELECTRE, PROMETHEE, NAIADE, AHP).
3) Are nature values commensurable?	*Natura economica is accepted*. The CBA as well as most MCA techniques can give valid policy recommendations.	*Natura economica is rejected*. Deliberative processes, or stakeholder group participation processes, can provide more valid information by identifying appropriate nature value dimensions. Analysis by an appropriate MCA technique can take place in a second step (e.g. REGIME).
4) Can the affected individuals' preferences be aggregated?	*Homo economicus is accepted*. The CBA as well as most MCA techniques can give valid policy recommendations.	*Homo economicus is rejected*. Deliberative processes, or stakeholder group participation processes, can provide more valid information by finding agreements on shared and normative values.

However, in many cases it would be considered irresponsible to exclude the ethical aspects when preparing for policy decisions, and the answers to one or several of the four questions would be NO. If, for example, question 1) is rejected, aspects like poverty reduction and conserving ecosystems can be important in addition to the goal of economic efficiency (Norton et al. 1998). In this case, it is recommended that an appropriate MCA technique is applied in order to incorporate more than one overall goal of the analysis. Moreover, a deliberative process approach can be useful, because it allows for the incorporation of many different goals. Deliberative processes, or stakeholder participation, can also be combined with an MCA. It is recommended that experts are involved in the deliberative processes to avoid contributions from misinformed participants with theoretical biases.

If one or two of the questions regarding *Natura economica* (2 and 3) are rejected, qualitative techniques that can give a better overview of more appropriate environmental values are recommended. They include stakeholder participation by group or deliberative processes. In addition, it is recommended that an MCA technique (e.g. REGIME) that applies an ordinal scale is applied in combination with the group participation strategy. The alternatives are then simply ranked (Janssen 1992).

If question 4) about *Homo economicus* is rejected, emphasis should be put on identifying stakeholders' or citizens' real preferences, priorities or wants that better reflect diversity. Although aggregation of individual or group preferences is difficult, it might be useful to structure the debate by combining the deliberative process with an MCA technique.

In general, a combination of a suitable MCA technique and participation of stakeholders or citizens can often be recommended as a tool for improved environmental policy advice, particularly when it is responsible to include ethical aspects in the analysis (including Munda 2004; Stagl 2003; Clark et al. 1998). These techniques are good alternatives to cost-benefit analysis.

7. CONCLUSION

As I have illustrated in the different sections of this paper, there is disagreement about the assumptions made about *Natura economica* and *Homo economicus* in cost-benefit analysis. Furthermore, there is disagreement about whether a single policy goal is sufficient and whether cost-benefit analysis is objective or not, and hence, about whether other tools which can provide more valid policy recommendations should in some circumstances be preferred to cost-benefit analysis.

Environmental policy makers should be aware of the assumptions made about natural goods and human behaviour in cost-benefit analysis, their divergence from real world observations, and how this defines and influences the outcome

of the analysis. I recommend that the differences between assumed and observed characteristics of both the environment and the human behaviour are as small as possible. To encourage awareness of such differences, this paper provides a total of four questions that can be asked by the environmental policy makers (table 1) as a guide. If the answer to these questions is YES, policy recommendations based on cost-benefit analysis are understood to be reliable. However, if the answer to any of the questions is NO, multicriteria techniques and participatory processes with stakeholders or citizens can provide environmental policy makers with more valid information. This is particularly the case when more than one goal must be included in the analysis, when the environment cannot be considered as a bundle of commodities, when environmental values are incommensurable and when people have interests and roles other than those of an individual consumer.

NOTES

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[1] The difference between behavioural and experimental economics is not large. Behavioural economics was developed in the US and Canada, whereas experimental economics was developed in Europe, in particularly in the UK. Experimental economics has more frequently taken place in 'laboratories', that is, in arranged settings, whereas behavioural economics more often took place in real market places.

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