Aalborg Universitet

AALBORG UNIVERSITY
DENMARK

Ethics and Cost-Benefit Analysis

Arler, Finn

Publication date:
2006

Document Version
Publisher's PDF, also known as Version of record

Link to publication from Aalborg University

Citation for published version (APA):
Arler, F. (2006). *Ethics and Cost-Benefit Analysis*. Aalborg: Technology, Environment and Society, Department of Development and Planning, Aalborg University. Research report, No. 4

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

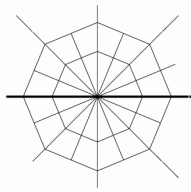
? Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
? You may not further distribute the material or use it for any profit-making activity or commercial gain
? You may freely distribute the URL identifying the publication in the public portal ?

Take down policy
If you believe that this document breaches copyright please contact us at vbn@aub.aau.dk providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from vbn.aau.dk on: November 14, 2019

Research Report 4 2006

Finn Arler
Ethics and cost-benefit analysis



Technology, Environment and Society

Department of Development and Planning
Aalborg University

Colophon

March 2006
ISBN 87-91404-12-6 (electronic)
ISSN 1603-9882
© Author

Publisher:

Division of Technology, Environment and Society
Department of Development and Planning
Aalborg University
Fibigerstraede 13
Denmark-9220 Aalborg Oest
http://www.plan.aau.dk

Scientific advisory board:

Professor Per Christensen
Professor Frede Hvelplund
Professor Andrew Jamison
Professor Anette Kolmos
Professor Arne Remmen
Librarian Kirsten Skou Hansen

Author:

Finn Arler

Layout:

Annelle Riberholt

Table of contents

Part I Origins and basic design 5
Preface 5
From moral and political philosophy to cost-benefit assessment 6
The antigue origin 6
Quantifying ethics 8
From political economy to economics 10
The basic assumptions in welfare economics 13
Cost-benefit analysis - a short history of the tool 15
Core elements and principles in cost-benefit analysis 17
Step 1 Identify the problem (market failure) and seek promising solutions 18
Step 2 Define and delimit the impact analysis 19
Step 3 Describe the impact 21
Step 4 Attach economic values to the various kinds of impacts 21
Step 5 Discount for time to find present values 23
Step 6 Add up costs and benefits 24
Step 7 Carry out sensitivity tests 25
Step 8 Compare the outcomes and rank them 26

Part II Problems and limitations 27
Monetising beyond markets 27
Monetising losses of human lives 27
Monetising critical and unique resources 32
The distributive problem 35
Distribution within generations 35
Distributions across generations 37
Consumer sovereignty and the problem of the ”rational fools” 41
The problem of social motives 43
The use of cost-benefit analysis 45
References 48

ABOUT THE AUTHOR

Part I: Origins and basic design

Preface

The purpose of this research paper is threefold. Firstly, I will trace the origins and jusification of cost-benefit analysis in moral and political philosophy. Secondly, I will present some of the basic features of cost-benefit analysis as a planning tool. Thirdly, I will bring special attention to some of the main ethical difficulties which one is inevitably faced with when using cost-benefit analysis as a planning tool.

Cost-benefit analysis (or, as it is usually called in the U.S.: benefit-cost analysis) is not an altogether unambiguous concept. To begin with one can distinguish between two kinds of cost-benefit analysis. On the one hand, there is the specifically economic kind of analysis, which emerged together with microeconomics and neoclassical economics during the 19th century. In this case the value or significance of everything needs to be expressed in monetary terms and based on (actual or virtual) market values. On the other hand, there is a broader kind of analysis, which is not exclusively economic in this sense, but includes assessments with at least some descriptions of costs and benefits expressed in non-economic and qualitative terms.

In general, though, cost-benefit analysis refers to the quantitative economic kind of analysis. Even then, however, it is necessary to distinguish between two approaches to the valuation procedure (Campen 1986, 26f). On the one hand, there is the "conventional" approach, which sees cost-benefit analysis as applied welfare economics with its standard valuation techniques. On the other hand, there is the "decision-making" approach, which holds that the actual decision-makers should influence evaluations related to controversial parameters like, for instance, risk and uncertainty, the relative weight attached to the interests of different social groups, or non-economic elements like loss of human lives, irreversible environmental impacts, etc. The conventional approach, where the analyst takes on the role of a neutral expert who only relies on mainstream economic methods and principles like efficiency and maximization of economic benefits, is the most commonly used of the two.

Thirdly, one can distinguish between private and public cost-benefit analysis. In the first case the point of view is the private company or consumer, and only the company's or consumer's own interests are relevant. In public cost-benefit analysis, on the other hand, the point of view is the public at large, wherefore all interests become relevant.

Public costs-benefit analyses can either take a local, national or global point of view. In the first two cases only a specific group of interests are included, whereas the last kind takes account of all interests on an equal basis. Again, in general, cost-benefit analysis refers to economic evaluations of public projects and policies, and more often than not from a national point of view where only the country's own citizens have standing (Boardman et al., 43f).

Fourthly, it is necessary to distinguish between ex ante and ex post cost benefit analyses. Most cost-benefit analyses are completed before (ex ante) a decision is made about a certain project or policy. It can also be made afterwards (ex post), however, in or-

der to make sure whether the decision was economically sound (or whether the previous ex ante analysis was reliable), or it can be revised continuously along with the execution of the decided project or policy (in medias res).

Finally, cost-benefit analysis needs to be distinguished from cost-effectiveness analysis. The purpose of cost-benefit analysis is to analyse a project or policy in order to determine, whether it is (or has been, or will be) a good investment. In this sense, it evaluates and recommends policies.

Cost-effectiveness analysis, on the other hand, aims at analysing how an already decided policy can be (or whether it has been) implemented in the most economically effective way, or how a certain amount of money can be used most effectively for a general purpose. The more general this purpose is, the less the difference will be between cost-benefit and cost-effectiveness analysis. If the decided policy is as unspecified as "more environment for the money," or "more happiness for the money," the two kinds of analysis more or less merge into one.

From moral and political philosophy to cost-benefit assessment

Cost-benefit analysis is usually conceived of as a sub-department of welfare economics which again is a sub-department of ethics. Or, to be more precise: cost-benefit analysis is a tool that is assumed to support ethical and political decisions by using a specific set of simplified assumptions. To understand how it works it is worth taking a look at its origins in ethical and political philosophy and detect which elements are preserved and which were left out.

The antique origin

"Every state is a community of some kind, and every community is established with a view to some good; (…) the state or political community, which is the highest of all, and which embraces all the rest, aims at (…) the highest good." This is how Aristotle's opens his treatise on politics (Aristotle 1962), which, directly or indirectly, has been a basic reference for all subsequent theories of politics. It is also the classical formulation of teleology or consequentialism in politics: what politics and, consequently, political science, are primarily about is furthering the highest good.

But what, then, is the highest good? Apparently, everybody seems to agree that at least one thing is good in itself and not just for the sake of something else, namely happiness, eudaimonia, and "identify living well and doing well with being happy" (Aristotle 1954, 1095a). The supreme good of a state is, accordingly, to make everybody live well and act well.

However, when trying to define happiness more precisely, people often tend to disagree. Most people believe that it is something plain and obvious, like "pleasure, wealth, or honour." Their opinions often differ from one another, though, and often even the same man identifies it with different things in different parts of his life (Aristotle 1954, 1095a). It seems necessary, then, to study it more carefully in order to make more considerate political decisions. This is what Aristotle did in his ethics, and before leaving him it seems appropriate to bring attention to a few of the main points, which are of particular interest in relation to cost-benefit analysis.

Firstly, Aristotle draw attention to the fact that happiness is primarily a consequence of doing good, of acting in accordance with virtues like justice, courage, temperance, friendli-

ness, generosity, reflectivity, wisdom, good judgement, etc., rather than simply the result of being wealthy or of living a life of ease and luxury. The good life is a life of virtue and substance.

Consequently, the first goal of politics cannot be merely to promote satisfaction, understood simply as transitory subjective feelings of pleasure – whatever may have caused these feelings – but rather to encourage virtuous actions. We should never be too hard on ourselves, though, and try to turn our back to all the material goods, which can make our lives more pleasant, while striving for perfection. "Virtuous and liberal" is the appropriate formula placing us midway between a life too easy and a life too hard (Aristotle 1962, 69f).

Secondly, the happiness of a person or of a community cannot be measured simply by aggregating all the single instances of feelings one happens to have throughout one's life. A human life is a closely knit unity, not a collection of separable anecdotes. All the actions and incidents a person performs and experiences throughout his or her life are tied together into one single narrative, which we try to make as meaningful as possible.

Thirdly, because people have different qualities and capacities, they differ in their specific aims. There is not one specific model of the good life which fits all. Different lives suit different people. The state should not strive for complete unity, as Plato recommended in his Republic, and "reduce harmony to unison and rhythm to a single beat," as Aristotle puts it (Aristotle 1954, 65). On the contrary, plurality, diversity and an appropriate balance between the different parts is what keeps the political community alive (Aristotle 1962, 57). This calls for some kind of democracy, because the many together provides a broader, more sensitive and differentiated view than the few, no matter how clever these few may be, for a certain amount of private ownership or rights of use, and for exchange of goods (on markets or elsewhere), in order for everybody to be able to concentrate on the areas where he or she performs best.

Fourthly, however, even though the use of money can be a very powerful device in the effort to establish a good life, because it makes a division of labour possible and together with this a diversity of goods and an increased production all around (Aristotle 1962, 63), money should never be treated as an end in itself. We should therefore be careful not to let money-making, chrematistike, take its own course independent of the aims in the general household balancing, oikonomike, and "turn all qualities into money-making qualities, as though that were the end and everything had to serve that end" (Aristotle 1962, 45). In this case we would become slaves of a limitless desire, which can never be satisfied. Likewise, excessive greed and excessive inequalities could very easily damage the friendly ties, which hold societies together, and which form the strongest source of happiness.

Aristotle's highly influential reflections on the good life and its political implications were addressed to the general public of citizens. This is the forum which was most suited to determine the outcome of communal affairs on the basis of common deliberation. The weighing of opposing interests and obligations could thus be made by the citizens themselves, giving due respect to the arguments and opinions of the most well-informed and the most virtuous – just, temperate, wise, careful, and patient – men amongst them. Due to the qualitative differentiation of happiness, Aristotle never even thought of specifying a foolproof method for determining the best outcome in complex ethical and political matters. Methods could never substitute for rational dialogue and virtuous judgment.

Quantifying ethics

Even though substitution may not have been their final ambition, many philosophers and economists in Europe during the 19th century did try to give methodology a much more prominent position in ethics. This is what turned into welfare economics and, later on, cost-benefit analysis. When looked upon in retrospect, the first steps were taken as early as the 17th Century – inspired, to some extent, by the antique writer Epicurus and his followers (Epicurus 1994).

There are several reasons for this. Firstly, the city state, the polis, was replaced by the much larger territorial state as the main political unit, making the differences amongst citizens more significant and political deliberation about the common good and the qualitative differentiation of happiness more difficult (cf., among others, Dahl 1989).

Secondly, the market had expanded during the previous centuries to a scale which outmatched Aristotle's own experiences, developing new habits of comparing qualitatively different things quantitatively on the basis of a common denominator. Business became more marked off from custom and other concerns, and the rights of individuals against each others and against the community were more sharply defined (cf. also Marshall 1920/1946, 5).

Thirdly, the success of quantitative and mathematical physics and mechanics in the wake of the scientific revolution installed a new pattern of inquiry as a serious competitor to the dominant Aristotelian model which, due to its intrinsic connection to a qualitative end perfectionist worldview, resisted quantitative operationalization. A "Mechanique Sociale" were expected one day to be placed next to the "Mechanique Celeste" (Edgeworth 1881, 12), the theory of economy next to the science of statistical mechanics (Jevons 1871, viii).

However, the ambition of finding a quantitative method of ethics may never have turned up, nor been fulfilled without the acceptance of two basic inventions. The first of these were the identification of new candidates for the role as common denominator. The Aristotelian 'happiness' and 'highest good' appeared too complex, qualitatively coloured and impossible to operationalize in any simple, straightforward way.

Instead, a set of apparently neutral and, in principle, much easier quantifiable concepts were introduced – by British authors like Thomas Hobbes (Hobbes 1651/1968) and David Hume (Hume 1751/1966 & 1748/1972) – along with a neutralisation of the concept of 'happiness' itself: human beings were now seen as machine-like creatures driven by blind 'passions,' 'desires,' and 'appetites,' seeking 'power' and 'utility,' in order to obtain 'pleasure,' 'delight' and 'welfare' (or driven by 'aversion' in order to avoid 'displeasure' and 'pain').

In the theories of these authors the good became synonymous with that which gives the greatest subjective pleasure (or the least pain), no matter how it may be obtained, or with what is most useful in achieving the desired pleasure or avoiding the undesired pain. Human beings were conceived primarily as pleasure-machines, as the British economist Francis Ysidro Edgeworth later put it (Edgeworth 1881, 15), and reason were seen as a calculative instrument the main role of which where to maximize the satisfaction of the subjective passions by refining them into (economic) interests (Hirschman 1977).

The second invention, which came along with the first, was the introduction of a simple and easy to work with two-sided image of human

beings. On the one hand humans were viewed as primarily selfish individuals seeking their own utility or pleasure out of "self-love" and in opposition to everybody else. Instead of a community conceived of as an expanded friendship – this was Aristotle's model – the new image was one of a "private society" (Rawls 1972, 521f) of self-interested consumers without any truly committing bonds (family, friendships, social unions, or communities) between them. Society was believed to be kept together only by an unspoken contract based on mutual advantage, where institutionally secured stability of life, liberty and possession in the form of private property became an overruling goal.

On the other hand, however, the very same individuals were seen to have a more or less developed "general benevolence" or "humanity" or "sympathy with public interest" (Hume 1748/1972, 229; Hume 1751/-1966, 54, 67, 109ff), which – once private property is secured – moves them beyond the narrowest kind of self-interest, and sees usefulness in a broader perspective: "Usefulness is agreeable, and engages our approbation (…) But, useful? For what? For somebody's interest, surely. Whose interest, then? Not our own only: For our approbation frequently extends farther. It must, therefore, be the interest of those, who are served by the character or action approved of; and these we may conclude, however remote, are not totally indifferent to us" (Hume 1751/1966, 52). Not that they were expected to further a common good, understood as something separate from all the private interests. Useful for all meant useful for all separately.

The goal of society could thus be reformulated into maximizing private utility, which in turn could be equalled to maximizing pleasure and minimizing pain. This is exactly what Jeremy Bentham recommended in his famous dictum of hedonistic utilitarianism: the Principle of Utility (or Principle of Greatest Happiness), according to which every action should be judged by its tendency to contribute to the greatest possible "benefit, advantage, pleasure, good or happiness" (Bentham 1789/1996, 12), where happiness and the good is simply identified with subjective states of pleasure (and absence of pain), and where the interest of the community is nothing but "the sum of the interests of the several members who compose it" (ibid.).

Aristotle's complex consequentialism was thus reduced to welfarism. As self-seeking individuals everybody is expected to try to maximize his or her own personal pleasure and minimize his or her own personal pain; as moral, altruistic and benevolent persons they try to act in a way, which maximizes the total sum of pleasure or minimizes the total sum of pain.

The total value of an action is a function of the number of pleasurable subjective states it is expected to cause in each individual, multiplied by their intensities, durations and certainties, and adjusted for their relative propinquity or remoteness in time (Bentham 1789/1996, 38). If, for instance, we were to choose between three possible future states from an altruistic point of view, as in Figure 1 (next page), we ought to compare the consequences for individuals and select the one with the greatest sum – in this case State I.

	Possible future states		
	I	II	III
Individuals			
A	8	4	6
B	8	3	4
C	1	7	4
Sum	17	14	14

Figure 1. Comparison of possible future states in terms of the utility or welfare of individuals. The utility of an individual is in each state measured on a scale between 1 and 10, depending on the intensity, duration and certainty of the expected pleasures and pains. Notice that State I must be selected, even though this is the worst possible situation for C. Bentham did assume a law of diminishing marginal utility to be effective, though, wherefore increasing equality was likely to lead to an enlargement of total utility.

From political economy to economics

This hedonistic utilitarian scheme was not altogether satisfying, though. Firstly, the antagonistic opposition between the selfish and the altruistic side of human beings seemed, theoretically as well as in practical moral life, to be an unsatisfactory compromise, particularly as operationalization became an overriding goal.

The Scottish professor of Moral Philosophy Adam Smith was therefore celebrated for finally having cut this Gordian knot theoretically by uniting the two sides of human beings by help of "the invisible hand" operating behind the backs of the actors on the market (Smith 1776/1970; Smith 1790/1976, 184f): "It is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard to their own interest. We address ourselves, not to their humanity, but to their self-love, and never talk to them of our own necessities but of their advantages" (Smith 1776/1970, 119). At least in their "economic life" – not necessarily in family life or religious life – humans appear to be selfishly calculating creatures. A most unfortunate fate, one may think, but due to the harmonic world order provided by the "all-wise Architect and Conductor" the selfish behaviour of all unintentionally turns out to result in consequences, which any impartial moral spectator would endorse as beneficial to all.

Without any sign of "human wisdom, which foresees and intends," general affluence occurs in societies where "the propensity to truck, barter and exchange one thing for another" (Smith 1776/1970, 117). Behind the backs of the agents private vices turn into public benefits, as the French author Bernard Mandeville put it in his Fable of the Bees. Adam Smith assumed, as did all of his followers, that if the market were left to work on its own without public interference, a balance or equilibrium would occur automatically – a balance, even, which could never be exceeded by human planning. Public interference should therefore only be considered in cases where the market for some reason failed to do a proper job.

Smith did not really make away with the distinction between selfishness and moral justification, though. He rather transformed it from a series of individual dilemmas to a general societal one. The individuals were relieved from a great deal of their moral burdens in specific situations, whereas the market sys-

tem as a whole needed moral justification. It was still essential that a moral spectator could find the overall results of the market processes satisfying.

Smith's arguments were not only that increased productivity, a result of the division of labour induced by competition, made the population more prosperous. He also found that the market encouraged people to develop a series of virtues essential for the good life, including autonomy, self-command and self-reliance, prudence, accuracy, diligence, frugality, innovation and industry, which the market promotes to such a degree that this outmatched its encouragement of vices like, first and foremost, vanity, greed, and unbounded selfishness (Smith 1790/-1976) as well as the one-sided development of the workers suffering from a harsh division of labour.

Smith argued at least partly in terms of virtues. Most of his adherents – later known as neoclassical economists – were utilitarians, however, and argued primarily in terms of utility and pleasure (or "units of pleasure-time-intensity" to use Edgeworth's phrase) as substitutes for the Aristotelian 'happiness.' For them, the basic problem was how to compare individual impressions of pleasure and pain across persons – and even across time: How is utilitarian calculation possible at all, when we cannot look into other people's minds in order to measure the intensity of their feelings?

Economic calculation seemed the right answer to this problem. For William Stanley Jevons, for instance, economy was nothing but an indirect "Calculus of Pleasure and Pain" based on "the mechanics of human interest" (Jevons 1871, vii and 24; Jevons 1988, III.1). Its object was explicitly to maximise happiness by purchasing pleasure at the lowest cost of pain (Jevons 1871, 27). The fundamental concept of value could accordingly only be based on utility in relation to pleasure. Because there are no units of enjoyment and sorrow, economic science has to do with what is second best: measuring the consequences as they are reported in the "private account books, the great ledgers of merchants and bankers and public offices, the share lists, price lists, bank returns, monetary intelligence, Custom-house and other Governmental returns" (Jevons 1871, 13).

This move actually brought Jevons away from the concept of utility found in hedonistic utilitarianism – where there was still room for discussions about objective usefulness and desirability – to the purely subjective concept of preference satisfaction, according to which people's preferences are simply revealed through their actual choices as consumers. Not only is the mind of an individual the final judge of his own quantities of feeling (Jevons 1871, 19); from the economist's point of view it must also be considered as the sole criterion in matters of what is in the individual's best interest (Jevons 1888, III.3). "Anything which an individual is found to desire and to labour for must be assumed to possess for him utility" (Jevons 1888, III.2).

Consequently, no matter what a person may happen to do, it is per definition in his or her interest. He or she can, as a matter of principle, never be wrong (although, perhaps, inconsistent, unless one assumes that in these cases the person's identity or "preference ordering" has simply changed). The value of a thing is thus determined not by its objective usefulness to individuals or to society at large but by its relative scarcity as perceived by the individual consumer, i.e., the thing is only valuable if the demand for it exceeds supply in a specific situation (cf. also Dupuit 1844/-1952, 89f). Hedonistic utilitarianism was thus replaced by preference utilitarianism. 'Pain' and 'pleasure' were replaced as basic con-

cepts by 'preference satisfaction' and 'preference frustration.'

The Italian economist Vilfredo Pareto focused on this difference in his Manual of Political Economy. In classical political economy most writers made use of the simple idea that if a thing satisfies the needs or desires of man, it has value in use or utility. This notion is imperfect and ambiguous on several points, however. Firstly, it was not sufficiently noticed that this value in use depended on the quantities consumed: "To be precise, it is necessary to speak of the value in use of a certain quantity … added to a known quantity already consumed. It was principally through the correction of this error on earlier economics that pure economics arose" (Pareto, 1927/1971, 110; cf. also Dupuit 1844/1952, 90f, 101) Instead of utility in general, the interesting thing for an economist is the marginal utility, or rather: the price people are willing to pay at the point of equilibrium, where "desires" and "obstacles" balances, so that just a slight change of price would make them turn down an offered good.

Secondly, it was not made clear enough by most economists, that in economics the word utility has a quite different meaning from that of ordinary language and of ethics in general. The economists' utility was only a pragmatic proxy for happiness. The drug addict's morphine, for instance, is not useful in the ordinary sense of the word, since it is harmful to him; whereas "it is economically useful to him, even though it is unhealthful, because it satisfies one of his wants." Instead of talking about economic utility, as if it was comparable to the concept of utility in ordinary language, Pareto therefore suggested the word ophelimity (Pareto, 1927/1971, 111).

His famous criterion of the economic optimality (later known as the Pareto-optimum), which became the fundamental criterion in cost-benefit analysis, was therefore also formulated in terms of ophelimity: "We will say that the members of a collectivity enjoy maximum ophelimity in a certain position when it is impossible to find a way of moving from that position very slightly in such a manner that the ophelimity enjoyed by each of the individuals of that collectivity increases or decreases.

That is to say, any small displacement in departing from that position necessarily has the effect of increasing the ophelimity which certain individuals enjoy, and decreasing that which others enjoy, of being agreeable to some and disagreeable to others" (Pareto, 1927/1991, 261). This is the state of equilibrium which an ideal market can be expected to tend towards. The market automatically finds local equilibria, and when it is complex enough, it will tend towards an overall equilibrium, which maximizes the marginal utility or ophelimity of all.

The fact that a commodity, a project, or a policy is economically useful is not enough in itself to recommend it, however. This is only the case within a pure economic science. When applied in real life situations the standards of the homo economicus has to be supplied with others from the vocabulary of the homo ethicus and maybe even some of those of the homo religious (even though Pareto himself was rather sceptical about whether there was much rationality to be found here). In real life, the preference utilitarianism of economic science was not enough. The standards of pure economics could not be used without supplementary considerations.

Alfred Marshall made a similar point in his Principles of Economics. From a purely economical point of view all incentives to action must be treated as primâ facie equal, and the economist "does not attempt to weigh the real value of the higher affections of our nature

against those of our lower" (Marshall 1920/-1947, 16). When he speaks of 'utility,' he implicitly think of it as the correlative to 'desire' or 'want,' but this is to some extend misleading, because "desires cannot be measured directly, but only indirectly by the outward phenomena to which they give rise." The only measure he is allowed to use is the price which a person is willing to pay for the fulfilment or satisfaction of his desire, and it can only be assumed implicitly, that "the resulting satisfaction corresponds in general fairly well to that which was anticipated when the purchase was made" (Marshall 1920/1946, 92).

One has to admit, however, that many wishes are, for instance, too impulsive or result from habit. Some can even be labelled as perverse or morbid. Others are based on futile expectations that are never fulfilled. If one could actually measure both the revealed preferences and the actual satisfaction or happiness, the two curves would undoubtedly be quite different (Marshall 1920/1946, 92f).

Still, because real satisfaction and happiness – and together with this: real utility – cannot be measured directly, economists have agreed to content themselves with the revealed preferences only, making a kind of trade off between, on the one hand, the loss of accuracy and sensitivity and, on the other hand, the larger opportunities for exact methods. Moreover, by using broad averages in order to counterbalance one another the personal peculiarities of individuals, the average willingness to pay to obtain a benefit or avoid an injury may after all be a reliable measure of the average benefit or injury (Marshall 1920/1946, 18; cf. also Jevons 1871, 22f).

The crux of the matter is that regardless of what people may happen to choose, it is now – within economic science – per definition considered to be in their interest, because their interests are defined by their mutually separable preferences, which are revealed, and can thus be measured, through their market behaviour. The welfare of two persons can easily be compared, then, because the values of both A's and B' satisfaction of preferences are both commensurable and directly measurable by their willingness to pay for it.

The basic assumptions in welfare economics

The status of the specific economic concepts of 'value' and 'utility' and the relation to their extra-economic counterparts in ordinary life has given rise to a number of recurring dilemmas in economics. Is economics a science, a political ideology, an art, or a social engineering methodology? Is it a descriptive or normative discipline? Can it make recommendations on its own or can it not? Is it an empirical science or a speculative construction based on a series of rather implausible assumptions? Is there is a high degree of correlation between economics and ordinary life, as Marshall suggested, or is the modest attitude of Pareto more appropriate?

Most economists do not consider economics primarily to be a pure science. In the words of Pigou: "Its purpose its rather practical and utilitarian, concerned chiefly to lay bare such parts of knowledge as to serve, directly or indirectly, to help forward the betterment of social life" (Pigou 1912/1999, 4; cf. also Samuelson 1948, 5 and 15). The bridge between economic science and total welfare should not "rust unused" (Pigou 1912/1999, 13).

At the same time, however, many economists tend to see their discipline as some sort of value-free enterprise. Economists who see themselves as making 'descriptive' or 'predictive' research, trying to leave it to others to supply evaluative standards, are there-

fore more common than those who explicitly see themselves as welfare economists (Sen 1987, chp. 2) – although both parties primarily rely on Pareto optimality as evaluative criterion. Still, no economic theory can avoid normative assumptions and statements. To use economic efficiency as a goal is in itself a normative decision. As I.M.D. Little has put it: "Some feel that economics becomes unscientific if value judgments are admitted: they are trying to fly without wings" (Little 2002, 23). Consequently, economists have to justify that they actually help improving social utility, welfare – or happiness, or the supreme good. I shall return to this question in Part II.

Let us assume in the rest of this Part that there is enough correlation between economics and real life to make welfare economic science relevant in planning. Before we proceed, it seems appropriate to sum up the assumptions, which have been presented so far, and which continues to be core assumptions in modern economic theory, and to add a couple more:

- The common good, supreme good or social utility can be reduced to an aggregation of the utilities of individuals. Society is nothing but the sum of individuals interacting to their mutual advantage.
- The complete utility related to an individual can be reduced to an aggregation of separable preference satisfactions, no matter how and why these may happen to be attained.
- Individual preferences are assumed to be related only to consequences for the individual him- or herself. They do not include political preferences for more equality in society, for instance, or preferences for other people's flourishing, unless this is reflected explicitly in the individuals' market behaviour. Even if the individual can be observed to be willing to pay for these goods, it is often assumed that what he or she is actually paying for is some kind of personal satisfaction such as the "warm glow" following from virtuous acts or peace of mind.
- The marginal utility of goods is diminishing. For each extra unit of a certain good one gets, less utility is obtained compared to the previous units (unless otherwise proven).
- In general, desires or preferences are revealed through individuals' behaviour on the market, and their intensities (together with their expected duration and certainty) can be measured by the consumers' willingness to pay.
- The market provides a balance or competitive equilibrium, where social utility is maximized, as long as no market failures occur.
- Consequently, public interference is only appropriate in cases of market failure
- In these cases the aggregated costs and benefits of possible interferences should be measured through calculations based on shadow pricing, where ideal market processes are imitated as far as possible.
- Prospective projects and policies with should be ranked in accordance with their benefit-cost ratio, and the one with the highest score should be implemented first. Implementation of the remaining projects and policies should be continued until the public budget is used up, or the one combination of projects and policies should be chosen which maximizes net benefits within the budgetary limits.

It is thus a basic assumption that, due to the efficiency of the market, it is only in cases of market failure that public interference is needed for adjustment. This is done through the construction of theoretical markets, which as far as possible reflect the observed normal market behaviour of individuals. This is where cost-benefit calculations become relevant.

Cost-benefit analysis - a short history of the tool

Although the first study which could be called a cost-benefit analysis was carried out by the French Abbé de Saint Pierre, who studied the utility of public road improvements in details as early as in 1708, a more systematic treatment did not emerge until a group of French engineers at the École Nationale des Ponts et Chaussées made an effort to develop methodical procedures in the spirit of Adam Smith and his French adherent Jean-Baptiste Say in the first half of the 19th century (Ekelund & Hébert 1999). These engineers saw the purpose of public works explicitly as one of redressing market failures, wherefore their utility needed to be analysed in market terms.

The culmination of this theoretical effort was a series of influential articles written by the French engineers Auguste Cournot and Jules Dupuit in mid 19th century. In these articles they developed a number of points which are often associated with the so-called founding fathers of micro-economics, who wrote their most influential books in the second half of the 19th century. Dupuit, in particular, is recognized as the inventor of the so-called marginal utility analysis, where the value of a project is measured by the consumers' willingness to pay for marginal benefits in a situation which is assumed to be close to a competitive equilibrium (Dupuit 1844/1952).

Despite the efforts of the French engineers and a few other early attempts cost-benefit analysis in the spirit of neoclassical economics was not systematically applied until, in 1936, the U.S. Flood Control Act required that the expected benefits from planned flood-control projects should exceed their presumed costs (Campen 1986; Hufsmith 2000). This act was part of the New Deal anti-depression program of Franklin D. Roosevelt focusing on the creation of new jobs and giving new stimulation to the economy after the great Wall Street collapse. The Flood Control Act was the main result of a process where new planning instrument were introduced by the National Planning Board which was established in 1934, and the issue of flood control – or, more generally, management of water resources, including flood control, water supply, irrigation, navigation, hydropower, and later on: water-related outdoor recreation and water quality – became the spearhead of the introduction of cost-benefit analysis as part of public administration in the U.S.

In the following years various committees related to the public management of water resource continued to develop the principles and standards used in cost-benefit assessment. The most significant result of this process was the publishing of the report Proposed Practices for Economic Analysis of River Basin Projects by the Sub-Committee on Benefits and Costs of the Federal Inter-Agency River Basin Committee in 1950. This report, which soon became known as the Green Book, for a long time set the standard for the construction of cost-benefit analysis in relation to public investments (Hufsmith 2000, Caulfield 2000, Kneese 2000, Pearce 1998).

It explicitly used some of the controversial principles developed in neoclassical welfare economics, particularly in relation to the accounting of secondary costs and benefits on a national scale ("to whomsoever they may accrue") and to discounting future costs and benefits based on opportunity costs of capital rates, i.e. the rates which could be obtained from the most beneficial alternative investments.

It also triggered a heavy activity in developing cost-benefit analysis in various research institutions, of which the Harvard Water Program was the most influential. The Green Book was never fully adopted by the Federal Committee, however, due to disagreements over which secondary costs to include.

The basic principles and procedures recommended in the Green Book were adopted by the U.S. Bureau of the Budget in their Budget Circular A-47 from 1952. This Circular was used by the Bureau on all water related projects during the 1950's, the peak period of dam building, although with a strong emphasis on primary regional benefits.

Since then cost-benefit analysis has been a recurring feature in U.S public regulation, and from the early 1960's – when the Circular A-47 was replaced by the broader Senate Document 97 (Caulfield 2000) – it was adopted in other public investment programs, and along with the growth of government spending during the 1960's it was applied in new areas like transportation, health, and safety regulations (Campen 1986, 20). In general, however, the programs were still designed from a multiple purpose approach, where objectives like expenditure constraints, equitable income distribution, regional development, human health effects, and, only marginally, preservation of environmental quality were assessed along with that of economic efficiency. The programs did not try to measure these impacts in monetary terms, but considered them as 'incommensurables.'

This problem, particularly in relation to externalities, became a major issue of research in the US Environmental Protection Agency (EPA), which Richard Nixon established in 1970 (Pearce 1998, U.S. EPA 2003), and where various indirect "revealed preference" techniques were explored, despite the fact that cost-benefit analysis was prohibited in relation to some of the basic environmental laws – the Clean Air, Clean Water, and Endangered Species Acts – from the early 1970's (Cropper and Oakes 1992, 675; Arrow et al. 1996, 4; Nash 1989). At that time cost-benefit analysis had obtained a rather nasty reputation due to a series of studies, which mainly served as mere window dressing for predetermined positions on some dubious water regulation projects. A congressional sub-committee went as far as to conclude, in 1976, that cost-benefit analysis to a large extent was used as "an effective disguise for subjective advocacy" (Campen 1986, 52).

The EPA-research did help cost-benefit analysis getting a comeback as a primary tool in public regulation, particularly because health and environmental issues, hitherto largely ignored, were now included in the studies. Consumer valuations of externalities were inferred from property pricing in areas of high environmental quality, transportation costs to nature sites, etc.

These techniques were, particularly in the 1980's, supplied by "stated preference" techniques like the so-called contingent valuation based on Willingness-To-Pay surveys. This technique had been suggested as early as in 1947 by the economist Ciriacy-Wantrup, but it was not generally recognized until a couple of EPA-conferences in the 1980's brought it into mainstream economics (Hanemann 1994). The methods were acknowledged officially in the U.S. in the 1980 Comprehensive Environmental Response, Compensation and Liability Act, which included recognition of rights to sue for damages on non-use values. This inclusion later on led to a heated debate on existence value and liability of contingent valuation, particularly after the Exxon Valdez accident in 1989 (Portney 1994).

The essential idea was to internalize the externalities into the cost-benefit planning

method in order to be able to use a coherent evaluation scheme without 'incommensurables.' During the last three decades of the 20th century EPA funded more than 450 studies focusing on methods for economic analysis, particularly on measuring environmental costs and benefits (U.S. EPA 2004).

Cost-benefit analysis was officially recognized as a basic tool in U.S. federal planning when, in February 1981, president Reagan signed the Executive Order 12291, which requires that federal regulatory agencies use cost-benefit analysis (as the basic part of the so-called Regulatory Impact Analysis, RIA) on proposed regulations which are estimated to cost more than $100 million.

This was not all too radical a change, however, as previous presidents had already encouraged economic efficiency assessment of public investments, and although 'cost-benefit analysis' was not explicitly mentioned in Jimmy Carter's Executive Order 12044 from 1978 or in President Ford's Executive Order 11281 from 1974, the weighting of economic gains and losses were nevertheless strongly recommended as part of what Ford called Inflationary Impact Assessment (later renamed to Economic Impact Statement) and Carter called Regulatory Analysis (RA) (Campen 1986, 20; U.S. EPA 2003). So it was in Bill Clinton's Executive Order 12866 on Regulatory Planning and Review from 1993 recommending Economic Assessments (EA), which through the Office of Management and Budget (OMB) still sets the standard for economic evaluations of public initiatives.

In the period following Reagan's Executive Order the focus was turned from public project investments to policies and regulatory actions, and the implicit aim was to prevent "over-regulation" (Pearce 1998, 87; Campen 1986, 54f). 'De-regulation´ and 'efficiency in public expenditure' became the new buzzwords, not only in the U.S., but in many other parts of the world as well. Cost-benefit analysis does not a priori recommend deregulation and privatization, however, even though the strong commitment to market mechanisms obviously pulls in this direction.

Core elements and principles in cost-benefit analysis

According to the neo-classical paradigm cost-benefit analysis should only be used in cases where public interference becomes relevant due to the presence of a market failure. Some of the most common cases are:

- When the market cannot provide certain goods without public planning and/or interference. This is primarily the case in relation to the basic infrastructure: transport systems, water supply systems, sewage systems, garbage disposal systems, energy transport systems, research facilities, etc., and to their regulatory and institutional setting: energy policy, transport policy, agricultural policy, cleaner technology policy, etc.
- When public projects may help the market getting started again in cases of regression and unemployment (although not all welfare economists would accept interferences in this case).
- When the values of some costs or benefits, the so-called externalities, are not registered on the market. This is first and foremost the case with current and future environmental and health effects like the consequences of an enhanced greenhouse effect, loss of biodiversity and nature quality, eutrophication, toxic or eco-toxic chemicals, etc.

The essential idea of the method is to compare a scenario, which includes the realization of a promising project or policy (or the closing of a problematic project/policy), to a scenario without this project or policy and/or to scenarios with alternative projects or policies. The basic principle is that the one project or policy should be chosen, which leads to the scenario which scores best in economic terms. Present as well as future cost and benefits are estimated through so-called shadow pricing, i.e., the consumers' expected willingness-to-pay on the margin, assuming that the market is working close to its optimum (within certain unalterable constraints). In principle, all those projects or policies should be realized, which come out of the analysis with a positive score, and therefore potentially enhance the welfare of at least one individual without declining the welfare of others (who can, in principle, be compensated).

Projects and policies with a positive score thus pass the so-called potential Pareto-improvement test in accordance with the so-called Kaldor/Hicks criterion: a project or policy is an improvement, if, in principle, the gainers could compensate the losers even if they do not. It is only a potential improvement according to the Pareto criterion referred above, because somebody is actually going to be worse off without compensation.

It is generally accepted as the basic criterion in cost-benefit analysis, though, for pragmatic reasons – almost no project would comply with the strict Pareto criterion – assuming that in the end there will be a balance between gainers and losers of different projects and policies, or that everybody will gain from general economic improvements.

In the following paragraphs the typical steps of the analysis are presented. Apart from a few minor variations, the overall design of the procedure is generally accepted (cf. Campen 1986, U.S. EPA 1983/1991, OMB 1996, Layard & Glaister 1996, Boardman et al. 1996, Finansministeriet 1999, U.S. EPA 2000, Møller et al. 2000). What is much more controversial, however, is the choice of assumptions and methods used in each of the procedural steps as well as the range of impacts to include. I shall return to some of these controversial issues in the following chapter.

Step 1
Identify the problem (market failure) and seek promising solutions

According to the neoclassical economics paradigm, the standard problems which justify public action are market failures. The identification of a market failure and the justification for public action is therefore the first step in cost-benefit analysis. For example, although it seems reasonable to build a bridge across a river in order to save time, and many truck and car drivers can be expected to be willing to pay their tiny part of it, no private company may be ready to initiate the construction right away due to the high construction costs, the risks involved, existing public plans and regulations, etc. So the market cannot solve the problem without a certain amount of public involvement.

The next step is to find the most promising projects (or changes in public regulations) which could solve the problem at hand. In the case mentioned, building a bridge may seem the most obvious solution, but there may also be other ways to solve the truck and car drivers' inconveniences. More ferries, for example. The selected solutions can then be varied in many ways: time and scale, renting or purchasing, changing location, varying quality targets, etc. (cf. also U.K. Treasury 2000, 18). These are only the most obvious answers, however.

More comprehensive kinds of planning policies – relocation of the local industries, for instance – may also help to solve the problem. In general, however, due to the neoclassical paradigm, these more comprehensive solutions are seldom tried, because they interfere more with the market mechanism, which is accepted as the most appropriate means to improve public welfare. The general assumption has typically been that piecemeal engineering, to use the Austrian philosopher Karl Popper's expression (Popper 1974), is always preferable to comprehensive planning.

With the move from project investment to policy and regulatory action as the main field for cost-benefit analysis, this has changed to some extent. Policies are always more comprehensive than projects. There are also usually more alternatives to choose amongst: improved information, control and command, performance-based standards, taxes, fees, charges, subsidies, marketable emission permit systems, deposit-refund systems, voluntary agreements, etc. The selection of alternatives depends not only on the nature of the issue at hand, but also on tradition, political signals, approach fashion, etc.

In many cases a solution has already been proposed by the public authorities, and cost-benefit analysis is then applied in order to determine whether the proposed policy or project is as worthwhile as it seems to the authorities proposing it. Consequently, the analysis only covers a fairly narrow range of projects and policies, in most cases only the proposed project or policy in various designs.

In theory, the proposed project's benefits should be compared with those of all other possible projects, even in other policy areas (health policy, for instance), in order to find the most beneficial ones. In practice, this is never done (Boardman et al. 1996, 13). In any case, there is inevitably a balance to be observed between thoroughness of analysis and limits of practicality (OMB 1996, 4 and 7).

It is worth remembering that cost-benefit analyses are extremely costly. A ten year old study showed that the US Environment Protection Agency on average spent $700.000 (1996 prices) on each analysis of proposed regulations which fulfilled the criteria in Reagan's Executive Order (Boardman et al. 1996, 12).

Step 2
Define and delimit the impact analysis

Next step is to define and delimit the analysis. There are three important questions to answer in advance. The first question is how many aspects of the project, the life cycle of a bridge, for instance, should be included. The standard answer is that all significant impacts should be taken into account, but significance is seldom a quality which is easy to agree upon. It is not altogether obvious which impacts to include.

We are faced with questions like how far away in time and space impacts should be taken into account. Building a bridge will have consequences in many links, where the precise causal relationships are often difficult to specify. The well-known example of an Amazon butterfly causing a storm in China when circumstances are right illustrates the difficulties involved in specifying the causal chains in an environment evolving in nonlinear processes. Conclusions are necessarily preliminary, uncertain, and very often based on controversial scientific knowledge. It has to be decided, too, which geographic as well as time scales to use. In practise, due to limited amounts of time and resources, only a rather narrowly defined part of the consequences is typically described. If, in accordance with the piecemeal engineering approach, the project

or policy is considered as a marginal change – as is most often the case – this will support the use of a narrow definition, too.

Secondly, before describing the impacts it is necessary to identify a baseline scenario against which the proposed policy or project should be evaluated. The specification of baseline conditions has significant influence on the final result. One possibility is simply to use status quo as baseline. Another is to pick the most likely scenario, if the policy or project is not carried through, based on relevant trends. In the proposed bridge case, it can be estimated how traffic is likely to change over time, how the general economic state of affairs can be expected to alter, etc.

This kind of baseline scenario building is often burdened with huge uncertainties. Several highly unpredictable factors are often of crucial importance in long term scenarios. Let me just mention a couple of examples. Firstly, assumptions about technological innovation with and without a proposed project or policy are difficult to handle due to the very nature of innovation. What makes it even more difficult to deal with is the fact that technological innovation is not exogenous to the implementation of the proposed project or policy but often to a large extent dependent on this (Löschel 2002). Secondly, assumptions about long time future demand cannot be anything but shaky; this is particularly true for goods like scarce environmental resources.

In the OMB and EPA Guidelines it is emphasized that the specification of baseline conditions is demanding on the "honesty and integrity" of the analyst, wherefore all assumption should be clearly both identified and justified. The presence of components with great uncertainty and significant effect on the final results calls for the inclusion of more than one baseline in the analysis (U.S. EPA 2000, 21f; U.S. OMB, 9).

The third important question to answer is whether a local, national or global approach is most appropriate. This is a question of whose interests are recognized to have standing: only those of local people, the national or global human interests, or the interests of all including those of other species. One possible answer in cost-benefit analysis is that willingness to pay is the key to getting one's interest into the account. This would not only exclude the interests of other species than humans, but also effects which are not recognized by the potential victims (a market failure in itself).

Another answer is that it is only necessary to include impacts on members of the political community which pays for the project. If the analysis is sponsored by a nation state, for instance, improvements of the trade balance of the country is counted on the positive side, even if this result in larger problems in other countries. Similarly, if only the net benefits of the paying local community is included, the costs of a project falling on neighbouring communities within the same country become irrelevant, unless these losses are covered through national taxation.

It is basically an ethical question to decide whose interests are recognized to have standing. The answer is not determined simply by the range of effects, but depends just as much on the understanding of the closeness of the relationships (human as well as inter-special) between the individuals affected by the impacts. To leave the decision to be determined by actual market behaviour indicators is one possibility, of course. It is not a neutral one, however, but based on the rather precarious assumption that the market constitutes the best decision procedure on ethical matters due to people's general lack of mutual interest.

Step 3
Describe the impact

The probable changes caused by the project or policy in question are described and measured in relevant units. In standard cost-benefit analyses it is paramount that all impacts are quantified either directly or by the use of indicators. Whenever possible, impacts should be described in ways which turn them into potentially marketable goods. Otherwise it is more difficult later on to attach precise economic values to them.

In order for impacts to be counted in the cost-benefit analysis, they need to have an impact on the preferences of human beings. Economists typically distinguish between different kinds of preferences. Some preferences are related to the direct or indirect use value of a good. Others are related to option value, i.e., the value of being able later on to use the good. This value is often determined as the expected future opportunities multiplied by some probability factor.

Some economists estimate preferences related to so-called bequest value, i.e., the value (as experienced by current people) of leaving future generations, say, an area in good shape. This bequest value should not be mixed up with the actual value of a good (economically or otherwise) for future people. Finally, some preferences are related to existence value, i.e., the value (as experienced by current or future people) that something continues to exist even though it may have no present or future use value. Again, existence value should not be mixed up with intrinsic value (or inherent worth), i.e. the value or worth of entities which have their own good, independently of the value attached to them by human beings.

The inclusion of risk, i.e., the distribution of the probability of being hurt or injured by a project or policy, and uncertainty, i.e., the lack of precise knowledge about these (and other) probabilities, is a separate issue. In most cases it is necessary to use average numbers as well as statistical probability estimates in relation to some of the costs and/or benefits of a project or policy. This is often a difficult task, because different scientists may have dissimilar opinions on the issue at hand, or clear evidence is lacking. Full disclosure and transparency is therefore important, and assessments of a number of plausible alternative scenarios, or a sensitivity test reflecting the differing interpretations of experts, are often highly needed. Delphi methods or consensus meetings involving groups of disagreeing scientists have also been used.

Here, again, there is balance to be observed between thoroughness of analysis and limits of practicality. In accordance with cost-benefit analysis' focus on current consumer preferences, the actual consumers' risk valuations should be of particular interest, but these are seldom included. Sometimes a risk premium for particularly risk-averse individuals is considered, though (U.S. OMB, 18).

Step 4
Attach economic values to the various kinds of impacts

In order to be able to compare the various kinds of costs and benefits directly, these should all as far as possible be monetised, i.e., economic values should be attached to all impacts of the selected alternatives. In most cases, it is essential that all goods are measured with a precise value, and not just as more or less compared with other goods on a common scale. Some values can be measured directly on the market: labour costs, building materials, land, equipment, office facilities, etc. – assuming, contrafactually, a) that the market works in accordance with the theoretical ideal, and b) that, in general,

the measured impacts continues to have the same relative value.

Whenever there are obvious obstacles to this, like, for instance, the presence of monopolies, this should, in principle, be adjusted for in the analysis, but this is rarely done, and all the small market failures are simply ignored. Another problem, which is largely ignored, is the changing relative values of goods. This is particularly problematic in cases where long term impacts are assessed, and even more so when future people's preferences – and the resulting market terns - need to be included.

Cost and benefits are considered as opportunity costs, i.e., the economic value of benefits forgone or gained when a public project or policy is carried through, including costs of compliance, administrative costs, transaction costs, and time losses. In cost-benefit analysis, public project should, in principle, always be measured against the best potential alternative, the benefits of which thus become the costs of the project (Layard & Glaister 1996, 1). The most straightforward way to measure these costs is to conceive of them as lost or gained consumer goods and – assuming the market to reflect the potential benefits of alternative applications – let opportunity costs equal the marginal costs as reflected in present prices on the materials, labour, property, etc. needed for a proposed project together with the losses and gains of consumer opportunities experienced by individuals directly or indirectly affected by the project.

Sometimes it is not as simple as this, though. For instance, if the market prices in an area can be expected to change significantly due to the implementation of the proposed project, i.e., when supply is inelastic to some extent, this will influence opportunity costs. If the market price of a good becomes lower than a consumer would actually be willing to pay for it, measured by current market prices, there is, in accordance with neoclassical theory, a consumer surplus.

Likewise, if the market price becomes higher than a producer would actually be willing to produce and sell a product for, there is a producer surplus. If a public project or policy changes the prices on certain goods, the positive or negative changes in consumer and producer surpluses are considered in the cost-benefit analysis. Lost or gained surpluses are accounted as positive or negative opportunity costs (the negative ones are sometimes referred to as deadweight loss), assuming that they would have been used or are going to be used or invested somewhere else.

Another way to measure the opportunity costs of a public project is to measure the lost or gained investment opportunities in general. In this case it is not the opportunity costs of the specific materials, labour, etc. but of lost or gained capital in a more generalized sense. These costs, the so-called opportunity costs of capital include the not achieved returns from potential investments, typically measured on the basis of market rates of return.

There is no clear and commonly accepted rule telling when opportunity costs are measured as either lost consumer goods or lost investment opportunities. They are only directly substitutable, however, if one assumes a consumer's rate of time preference for consumption equal to the marginal rate of return of capital. Most cost benefit analyses treat opportunity costs as consumer costs and discount afterwards with a discount rate equal to the rate of return of investments (Arrow et al. 1996, 130).

Externalities are – positive or negative – incremental impacts which are not valued di-

rectly on the market. Examples of these are losses or savings of human lives, injuries and inconveniences, time losses or savings, increases or reductions of risks, losses of populations of certain species, impacts on nature quality, scenic views, losses or improvements of ecological services, inconveniences for other species, etc. In all these cases economic values are attached otherwise through various kinds of shadow pricing, assuming contrafactually the presence of an ideal market for non-priced goods.

This kind of shadow pricing can be done in a number of ways (cf., for instance, Cropper & Oates 1992; Pearce & Moran 1994, chp. 5; Pearce 1993, Appendix II; Hanemann 1994; Boardman et al. 1996, chps. 10-12; U.S. EPA 2000, chp. 7). The general principle is that the measurement should be made in a way which imitates the market mechanism as far as possible. For instance, non-prized goods like endangered species could be measured through so-called contingent valuation based on willingness-to-pay or willingness-to-accept surveys, where a representative group of citizens are asked, how much they would be willing to pay for saving the species, or how much compensation they would demand if the species eventually is lost. This is the stated preference approach, where individuals respond to hypothetical questions.

Some cost-benefit analysts consider this to be a rather unreliable way to make evaluations, though, and they prefer to use indicators based on actual market behaviour. This is the revealed preference approach. An example of this is the so-called hedonic pricing, where certain amenity values – peace and quiet, environmental quality, closeness to the sea, significant views, etc. – are reflected in property value. Other examples are valuation of time savings for various kinds of drivers based on their income related to the time saved, valuation of nature sites indicated from the travel costs people are willing to pay to reach the sites, or occupational-risk premiums in wages, indicating individuals' price for their willingness to accept incremental risks.

Still another approach is to measure the expected costs of establishing alternatives to a lost good, the costs of cleaning an area after use, or the costs of re-establishing a lost good. This approach implicitly assumes that society (now or in the future) is willing to pay for the restoration.The selection of methods depends not only on the matter at hand, but also on the chosen scheme for weighting the various interests. One basic dilemma is whether all interests should be taken into account on an equal basis, independently of ability to pay, or expected willingness to pay is a more proper measure. Most cost-benefit analysts tend to prefer the last solution, because it deviates less from what happens on real markets.

Step 5
Discount for time to find present values

Any public project or policy – building a bridge, for instance – has impacts for several generations. Actually, and this is a theme well known from science fiction literature dealing with time machines, any project will have irreversible consequences with long chains of impacts. In mainstream cost-benefit analysis it is assumed that future costs and benefits should not count as much as current ones. They should be discounted or transformed to the so-called net present value by a discount factor $1/(1+r)^t$ where r is the discount rate and t is a time index (counting years from project start). In order to do this it is necessary to set up a time scheme which shows when the various impacts are going to appear.

The main reasons given for discounting are that a) people are in general assumed to prefer to have current needs and wants satisfied

rather than those they may have in the future, or b) technological improvement and economic growth in society is assumed to make people richer in the future, c) people are expected to care less and less about future people the further away they are, because we know less and less about who they are and what they cherish, or d) future costs and benefits are more uncertain, because unforeseeable events may change the whole scheme. I shall return to discuss the validity of these arguments in Part II.

The choice of discount rate is extremely important in most assessments. In mainstream cost-benefit analysis it is often assumed that public investments displace private investments. Public investments should therefore do better in terms of interests than private investments; otherwise they should never be implemented. The right discount rate is accordingly believed to be the interest rate of the best or at least the average private investments, the so-called private rate of return of investment, reflected in the market rate of return, for instance, of long term relatively risk-free bonds or of the average investments (both adjusted for inflation).

This way one gets an estimate of the opportunity cost of capital, i.e., the before-tax rate of return to incremental private investments or, in other words, the missed opportunities for profiting from alternative investments. In this case the discount rate will typically be somewhere between 6 and 12 percent per year. It is a problem for cost benefit analysis, though, that there are several different market rates working at the same time due, for instance, to differences in risks (as perceived by the agents) in different areas.

It is necessary to distinguish between marginal, short-term projects and comprehensive long-term policies. In relation to long-term projects and policies which cannot be considered to be marginal, one could easily end up in a contradiction, if a high market rate of return is used, because this would inevitably influence the general increase in per capita income or rate of growth of consumption – with a corresponding decrease in the marginal utility of net benefits – both of which are usually assumed to be lower than the market rate, typically some 1 to 3 percent per year, although higher in periods of rapid growth and lower in periods of recession. It should be noticed that this rate varies from country to country and from time to time so that, in principle, different rates ought to be used. In practice, the same rate is generally used on all impacts.

Step 6
Add up costs and benefits

If all costs and benefits of alternative solutions are valued with the same denominator, the final aggregation is simple. One can simply pick up all the pieces, collect them, and see how profitable the various solutions are. Still, the aggregation can be made in a less straight-forward way, if it is assumed that one monetary unit of costs and benefits is not equally valuable to all. An alternative to the simple aggregation would be to give asymmetrical weight to the anticipated costs and benefits of different groups. The U.K. Treasury Green Book even demands that any lack of explicit adjustment for distributional impacts needs to be justified by the appraising agency (U.K. Treasury 2000, 25).

A weighted account seems particularly appropriate in cases where the potential Pareto-improvement (or Kaldor/Hicks) criterion is used, but individuals living under difficult circumstances are likely to get hurt. This choice would be consistent with various well-known ethical principles such as, for instance, the classical hedonistic utilitarian law of declining marginal utility of money, according to which

maximization of happiness (or of real utility instead of Pareto's ophelimity) demands equitable distribution of wealth, as well as with John Rawls' difference principle (or maximin principle), according to which "the higher expectations of those better situated are just if and only if they work as part of a scheme which improves the expectations of the least advantaged members of society" (Rawls 1973, 75). Following the first of these principles, one could, for instance, weight net benefits of various groups of people inversely proportional to wealth or income. Following the second principle, one could, similarly, increase the weight of net benefits of people with possessions or income below a certain threshold.

Apart from all the obvious practical difficulties of finding a reasonable way of doing this (which is one reason why it is seldom tried), a disproportionately weighted aggregation entails what many economists would see as the disadvantage of diverging the assumptions away from those working on the real market. For this reason mainstream economists avoid it: the two goals of maximizing wealth ("efficiency") and of making the social distribution equitable ("equality") should be kept separate, and not be mixed up in the analysis. At least, they argue, weighted cost-benefit analysis should never be made without a standard analysis to compare with.

Behind this recommendation lurks the general assumption, inherited from Adam Smith, that the market works best without interference, and that unfortunate outcomes is adjusted in due course by the market itself; people who lose in one game are likely to win in another, if the wealth of society is kept at a maximum. It could also be argued, though, that cost-benefit analysis is just one out of several tools that support decision making and that tools works best when they are kept as clean as possible. It is up to the decision makers, then, to mix the tools in accordance with their own standards.

Step 7
Carry out sensitivity tests

Due to all the controversial and precarious elements included in cost-benefit analysis, it is necessary to provide sensitivity tests based on alternative assumptions in order to see if decisions related to any of these elements are crucial for the final result.

Whenever this is the case, it is necessary to highlight the controversy by presenting conclusions of calculations based on alternative solutions to controversial issues. The following list includes some of the typical controversial and uncertain issues.

- Losses of human lives, injuries and health problems. How should the value of statistical lives and statistical injuries be estimated? Should the statistical lives of various groups of people be valued differently?
- Can value transfers from other studies be used in cases where data are sparse? Are the situations comparable, or, if not: how can they be made more comparable?
- Losses of non-human species or populations and other non-marketed environmental goods. How should we estimate indirect use value, option value, existence value, and bequest value? Are all kinds of values covered by the analysis?
- Discounting future impacts. Which discount rate(s) should we choose? Should all impacts be discounted? At the same rate?
- Dealing with risk and uncertainty. Can risks be quantified in more than one way? Are expert estimates dissimilar? Are uncertainties significant?
- Questions of standing. Whose interests should be included? Are some of the non-

represented interests significant?
- The question of baseline. Which variable factors and probable changes are included? Is there more than one reasonable estimate of social and technological development? How are future markets going to look like, and how can this be accounted for in the analysis?
- The alternative scenarios. Which ones are chosen and what is included?
- The theoretical framework. Do different economic theories assume different causal relationships?
- The question of equity. How should the distributive impact be dealt with? How would different assumptions influence the result?

If cost-benefit analysis shall be of any help in ethical and political decision making, it ought to highlight all controversial assumptions and present some thorough reflections on the impact of alternative assumptions. Otherwise cost-benefit analysis becomes totally unreliable and worthy of the bad reputation it acquired in the seventies (and still has). It is true, of course, that there is balance to be observed between thoroughness and practicality, but the sensitivity tests are the worst area to place savings, if a cost-benefit analysis should be worth the money.

Step 8
Compare the outcomes and rank them

Projects and policies with potential benefits, i.e., where the expected net present value is positive, should be ranked in accordance with their benefit-cost ratio. The one with the highest ratio should be implemented. In principle, implementation of all projects and policies with positive score should be continued until the public budget is used up (or the best mix of projects within the budgetary limits should be chosen).

In most cases it not as simple as this, however. Many costs and benefits are difficult to monetise in an unambiguous way, and in order to provide a reasonable foundation for political decision making it is necessary to present a number of impacts in a non-monetised way. This can be done, for instance, by the use of tables, where the importance of various hard to monetise impacts is estimated on, say, a scale from 1 to 5, and the estimates are defended by arguments. The use of procedures like this violates some of the basic principles in mainstream cost-benefit analysis – the monetisation demand, reliance on consumer preferences, etc. – but it makes the final outcome more trustworthy as well as more useful. The hard to deal with issues are not hidden behind controversial methodological decisions.

In practice, the ranking of projects and policies seldom follows the recommendations of mainstream cost-benefit analysis, but includes various other kinds of considerations such as distributive effects and matters of equity, enforcement and compliance problems, incentives for innovation, regional development, strategic importance, consistency with national and international legislation, etc. (cf. also U.K. Treasury 2000, 9f). I shall return to this at the end of Part II.

Part II: Problems and limitations

Cost-benefit analysis includes a large number of choices and considerations, many of which are controversial or includes a high degree of uncertainty. In complex cases there is room enough for a whole army of devils to move into the details. One of the key principles, which ought to be observed by all analysts, is therefore full disclosure and transparency in order for the conclusions to be tested and assessed by independent observers. Any analyst striving to live up to the previously cited U.S. Office of Management and Budget demand for "honesty and integrity" should highlight all potentially controversial or uncertain assumptions. This is particularly important in cases where assumptions are hidden in a specific methodology. Similarly, it is extremely important to present sensitivity tests based on alternative assumptions in relation to all controversial issues that have vital impact on the outcome of the analysis in order to separate robust conclusions from shaky ones.

These principles should be observed even more carefully when analysts address a general public not familiar with cost-benefit analysis. It is quite simply bad practice to present conclusions to the public as if they were the result of pure and unbiased science without mentioning any of the potentially controversial assumptions, which almost always have significant impact on the conclusions.

In Part II I will focus on some of the issues which are most likely to cause controversy, and which should therefore be treated with utmost care by analysts as well as by readers and users of cost-benefit analysis. All problems are somehow related to the basic idea of using the (ideal) market as the basic model and seeing economics as a science which is value-free apart from one single goal: improving the efficiency of satisfying private preferences by chasing Pareto optimums. I shall exemplify some of the problems related to the extension of market logic and economic calculation beyond the customary limits of the market: putting a price on human lives, on critical and unique resources, and on future costs and benefits. Next I shall discuss problems related to some of the basic assumptions which cost-benefit analysis has inherited from neoclassical economy. In the concluding section of Part II I will discuss the use of cost-benefit analysis more generally.

Monetising beyond markets

Monetising losses of human lives

It is a basic assumption in cost-benefit analysis that all cost and benefits need to be monetised in order to identify the most efficient solution. It is necessary, therefore, to attach economic values even to objects, which are not normally traded on the market. One of most controversial elements is the monetisation of human lives (or of potential losses of human lives).

Basically, there are two ways to approach this issue. On the one hand we have an approach in line with Thomas Hobbes' classical statement that a human being is just one more thing, the utility of which can be valuated on the market: "The Value, or Worth of a man, is as of all other things, his Price; that is to say, so much as would be given for the use of his

Power: and therefore is not absolute; but a thing dependent on the need and judgment of others" (Hobbes 1651/1968, 152). A person's value is relative to the needs and judgment of others, and these are expressed as willingness to pay in acts of exchange.

The market can accordingly provide an objective measure for the valuation of human lives. Hobbes does not distinguish between the value (or worth) of a human being in him- or herself and the value of the use of his or her labour power, and he can therefore quite easily put a price on human beings. The price of a lost human life equals the loss of its labour power in the expected remaining working period (assuming that nobody else is unemployed, capable, and ready to take over).

Obviously, it will have quite significant consequences, if it is generally accepted that the value of human lives depend on the market value of their labour power. For instance, the loss of an African man with a low salary will be much cheaper than the loss of a New York stock exchange gambler with a large income. The loss of an African woman, whose work is not registered on the market, would have no influence at all on the account, because she has an opportunity cost of zero on the labour market. The loss of sick or elderly people, who live off their pension and maybe are given extensive medical treatment, would even be counted as an economic benefit. However, even though attempts to get rid of these people would be recommendable from a narrowly economic point of view – and worth considering from that of a utilitarian satisfied with counting pain and pleasure – this would be considered a repugnant conclusion from any other ethical point of view.

Opposed to the Hobbesian approach we find the kind of argument, which has been put forward most forcefully by the German philosopher Immanuel Kant: "Whatever has a price can be treated as an equivalent to other things; that, however, which is raised beyond every price, and therefore cannot be treated as an equivalent, has a worth [Würde]" (Kant 1785/1965). Everything which can be treated simply as a means to satisfy human needs or wants has a price or exchange value and can be traded on the market. This includes human labour power, which is traded on the labour market. On the other hand, we cannot ascribe an exchange value to that which has intrinsic value or worth, and according to Kant this is the privilege of rational (human) beings. Rational beings should never be treated simply as means to satisfy external ends, but always also as ends in themselves.

Slavery, the buying and selling of human beings, was abolished long time ago, and no one would accept that people were allowed to kill each other, if only they paid the market value of the lost labour power. Nor do we, in ordinary situations, see the death of one particular, identifiable (and innocent) person as an acceptable price to pay in order to obtain a certain benefit.

This would be the case, for instance, if a medical company or a public hospital picked out somebody with the right genes and inflicting him or her involuntarily with a deadly decease in order to test a new drug, which is expected to help many others. In general, we accept the Kantian argument that human beings (or their flourishing) should never be treated as means only, but always also as ends in themselves. In this sense they are priceless (and not, as some economists, who miss the whole point, try to put it in order to defeat it: of infinite value).

At the same time, however, we cannot avoid making decisions, which shorten some people's lives. For instance, we do not spend the major part of our resources in hospitals trying to lengthen the lives of dying people, and

even if we did, this would eventually cause deaths somewhere else like, say, on disrepaired roads. Many economists argue that potential losses of human lives are likely to be forgotten in the process of decision making, if we refuse to put a price on them considered of as statistical lives. Let us assume for a moment, then, that it does make sense to put a price on (losses of) human lives. What exactly are we putting a price on in this case? Several suggestions have been put forward. Let me concentrate on three main candidates.

The first candidate is the loss of potential labour power. This is estimated in the so-called human capital approach. In this case we are faced with the problem of elderly people with a negative price, people who are not related to the labour market, etc. Getting rid of these people would improve net benefit. A hideous conclusion that is, indeed. One way to solve this problem could be to use the average income of an individual midway in a life of average length.

This would raise the problem immediately whether we are talking about the average national or global income and life length. In the first case the loss of human lives in poor countries would be far cheaper than in rich countries, wherefore the riskiest projects would be placed in the lands of the poorest without their previously stated consent. In the second case, the price would be so low that, particularly in rich countries, it would pay very well not to care about the loss of human lives.

Another way of estimating the potential loss of a human life is to estimate the total value of production losses due to mortal accidents and then divide this total value by the number of lost human lives. This method is used, for instance, by the Danish Road Directorate, and recommended by the Danish Ministry of Finance. It leads to a value around €300,000 per "statistical life" (1999-prices) (Vejdirektoratet 2001; Finansministeriet 1999).

However, an account of the loss of potential labour power does not include the losses inflicted on the relatives of a dead person. A second candidate is therefore the loss of potential labour power plus the pain and sorrow inflicted on relatives. In this case, however, there are no reliable market based values or prices to refer to. The loss of a spouse, a mother, a son, or a close friend has no true market value. In fact, if somebody asked you what you would consider a fair price for the realisation of a project, which he is about to put to work, and which can be expected to cause the death of your child, you would immediately denounce him to the police.

We could try to move a step away from the specific cases, and ask, for instance, how much potential victims and potential relatives of victims would find it equitable to pay to an insurance fund compensating the relatives of possible future (by now unknown) victims of a project, which would be profitable to themselves. A project would be acceptable only if it could actually sponsor a fund of a size, which could compensate relatives to future victims, and still be profitable. This way it seems that we can calculate an indirect measure of the value of a lost life. In relation to public project like roads or bridges the compensation of relatives could simply be estimated as that which the political authorities would be willing to pay as compensation, if they had to. This is how the Danish Road Directorate justifies the use in cost-benefit analysis of virtual compensations to relatives around €600,000 per lost life (Vejdirektoratet 2001; Finansministeriet 1999).

However, the payments from the fund would not truly be compensating those who actually loose the relatives, nor the victims themselves, of course. Instead, one might set up a

kind of gambling situation with losers and winners. In this case the price or value is not actually put on the loss of human lives, nor on the pain and sorrow of loosing a relative, but instead on the additional (or reduced) risk of loosing one's own or a relative's life that one is (voluntarily) ready to accept in order to obtain a certain extra bonus, or "the value of the reduced probability of death that is experienced by the affected population" (Viscusi & Aldy 2003, 6). This is our third candidate, then. This candidate is coherent with the Kantian line of argument, because it does not involve inappropriate pricing of priceless entities.

The exact compensation for a loss of a human life would in this case be depending on the likelihood of loosing as well as on the extra benefit one expects to obtain. Consequently, it cannot be the same in all kinds of situations. As the risk gets higher and the expected benefit gets lower, the price goes up and vice versa. Not linearly, but exponentially. The first percent of extra risk will be less expensive than the next percent, and the last 5 percent between 95 and 100 will be impossible to pay. It is therefore important to notice in which part of the spectrum the incremental risk is placed.

Moreover, because the willingness to pay for risk reductions (or to accept risk increases) is fairly differentiated, not only across individuals (of different age, gender, health status, life quality, risk aversion, etc.) but also across income groups and cultures, it is quite problematic to use just one average measure of risk acceptance covering all risks in all situations at all places. The various surveys that have been made only tell about the indirectly revealed preferences in a given sample of people living under a specific set of circumstances accepting a specified kind of risk. These results cannot be generalized to a universal measure of a "statistical life" (Viscusi & Aldy 2003, 18), but are often used as such through so-called value transfers due to lack of time and money for differentiated studies (U.S. EPA 2000, 88).

If risks are imposed involuntarily, i.e., without a stated consent, the price ought to be significantly higher, of course (and the project should often be reconsidered). Other factors which affect risk perception are whether the risks are ordinary or catastrophic; occasional or continuous; immediate, delayed or latent; man-made or not; well-known or not; controllable or not; possible to avoid through averting behaviour or not; necessary or not (U.S. EPA 2000, 91; Pearce 2000, 12 & 18f). These dissimilarities make it even more problematic to make value transfers, and even more so because the studies made so far are not very helpful in identifying the relevant factors that could explain significant variations (Pearce 2000). If these factors were all well known, adequate adjustments could be made in cases of value transfer by the use of so-called meta-analysis (or other more informal methods).

The primary approach to estimating the value of an additional (or reduced) risk is hedonic pricing, first of all inferred from statistics on wages in jobs with higher than average mortality risks, but price-risk trade-offs for seatbelt use, cigarette smoking, automobile safety, bicycle helmets, etc. have also been studied (in so-called "averting behaviour" or "consumer market" studies). Contingent valuation methods have also been used. These studies can be designed in many different ways, some of which are not particularly reliable (for a comprehensive account of methods and accomplished studies, see Viscusi & Aldy 2003). The basic idea is to multiply the additional (or reduced) risk by the extra (or reduced) income. For example, if 1000 workers accept an extra wage of $5000 due to an additional risk of 0.001 percent, i.e., one

of them can be expected to die during work, the value of a "statistical life" is $5 million (assuming, contrafactually, sufficient labour mobility and full information about actual risks).

Half of the U.S. hedonic labour market studies surveyed by Viscusi & Aldy find the cost of a "statistical life" to fall within a range of $5-12 million with a median of $7 million, but the studies vary significantly (Viscusi & Aldy 2003, 18ff). This is not far from the value recommended in the U.S. EPA Guidelines for Preparing Economic Analysis: $6.1 million (U.S. EPA 2000, 90). In the EU-sponsored ExternE-project the recommended value for "statistical lives" lost or gained within the EU is somewhat lower: €3.1 million, which is estimated on the basis of a survey of European studies (European Commission 1999, 232ff).

It is worth noticing that by far the highest risk in any of the surveyed studies were 0.2 percent; in most studies the risks were significantly lower. If the price on risks grows exponentially as the risks increase, the stated costs are only reasonable in low risk cases. At the same time the low risks makes people's behaviour quite unpredictable due to the difficulty of dealing consistently when confronted with such small numbers. Moreover, the studies only include the potential victims' own willingness to pay or accept, not those of their relatives, the inclusion of which may increase the value significantly (Pearce 2000, 26f).

It is also worth noticing that the willingness to accept risks is highly income-elastic; in countries with a lower average income than in the U.S. the costs of additional risks are lower. Several cost-benefit analyses of global issues, amongst which can be mentioned the ExternE-project, therefore adjust for this by multiplying the value of a "statistical life" by the ratio of the real GNP (GNP adjusted for purchasing power parity) in each country to the real GNP in the EU (European Commission 1999, 236ff).

An important consequence of this highly controversial adjustment is that damages causing losses of human lives will be much cheaper in poor countries. In Rwanda, for instance, the value of a "statistical life" is estimated to €58.000, whereas a "statistical life" in Norway is worth €3.5 million or some 60 times as much. This is quite obviously a problematic conclusion, particularly because the inhabitants of Rwanda will not gain anything from having the negative impacts of climate change fall in their country (thus making costs cheaper), unlike richer countries with significant emissions of greenhouse gasses. It is worth noticing, too, that the value of a "statistical life" would increase with economic growth, wherefore losses or gains of lives cannot be discounted for the same reason as other costs and benefits.

The values from the described procedure could also be used in a calculation of an average global value of a "statistical life." This is the kind of calculation lying behind the EU Commission's DG Environment's recommendation to use a value around €1.0 million (2000 prices) with an upper estimate of €2.5 million and a lower estimate of €0.65 million (European Commission 1999 and 2001).

A fourth and a fifth candidate should be mentioned, if only in passing, namely life-years lost and life-years remaining. In both cases it is not life as such that is valued, nor the incremental risk of loosing it, but the expected number of life-years lost or gained. Although many of the issues already mentioned are relevant in these cases as well, there are a couple of important differences, too. First of all, age is more important in these cases. In the first case (life years lost) children's deaths are much more costly than the death of older

people, because more life years are lost. In the second case (life years remaining) one can expect dissimilar reactions from people at different ages, particularly in cases of delayed and latent risks.

Generally speaking, there is no single value to attach to the loss (or saving) of a human life. There are various ways to estimate losses based on different sets of assumptions. Some of these differentiate considerably between different groups of people, due to differences in income, age, etc., whereas others seek averages. There is not one approach which is best in all respects. This is not a result one should be sad about, however. It only makes it more obvious that it is a political task to make decisions – including the selection of which methodology (if any) to rely on.

Moreover, to talk about "the value of a life" or "the value of a statistical life" is bewildering at best (cf. also OMB 1996, 25f). The fact is that I have not come across any convincing arguments on how to monetise the loss of human lives. After all, it is only circumstantial matters that are monetised: the value of lost labour, incremental costs of medical treatment, the value of risk avoidance, the compensation of relatives, etc., not the loss of a human life itself. Nobody can be compensated properly for their own death. Consequently, when constructing a cost-benefit analysis one should always make a separate account of expected losses or gains of human lives.

The choice of exposing factions of citizens to increased risks due to the provision of a certain good is basically a social task, based on weightings of monetised as well as non-monetised costs and benefits, not simply an aggregation of individual accounts. Individual valuations can only give decision makers some hints about their willingness to back up decisions.

Monetising critical and unique resources

It is generally assumed in cost-benefit analysis that goods and resources can be substituted without limitation. "If you don't eat one species of fish, you can eat another species of fish," as the American economist Robert Solow has put it, and if there are no fish left at all, you can eat something else. All resources are considered "fungible" (Solow 1993, 181); they can be replaced, and will be replaced without loss by others, whenever the price is right. In cost-benefit accounts it is therefore crucial to put the correct economic value on all kinds of resources in order to find the most economically sound solutions in cases of market failure.

There is one problem, though, which most economists recognize: the problem of critical resources, i.e., basic life-support resources like clean water or ecosystem stability (or resilience) which cannot be substituted for by anything else, and the loss of which may be irreversible or at least damaging for a significant period of time. This is a problem, which has turned up particularly in relation to the question of sustainability. Some hard core economists, supporting the weakest possible concept of sustainability, have argued that this is not a real problem, because the price of these resources will rise if they become sparse. This is not altogether convincing, however. Partly because many decisions are made on the basis of a very short time horizon, from which future damages are not visible. Partly because some non-substitutable resources just do not come out in large numbers. Still, it is not an easy task to identify the critical resources, which are not likely to be preserved in an appropriate way by the market mechanisms (Turner & Pearce 1993, Holland 1997, Holland 1999, Ekins et al. 2003, Ekins 2003, De Groot et al. 2003, Chiesura & De Groot 2003).

I have suggested that we distinguish between three kinds of resources as presented in Figure 2 (Arler 2001 and 2003) Firstly, there are exchangeable resources, which can be substituted for by other resources, as long as there are enough of these with sufficiently similar qualities, without any further problems. The standard example is fossil fuels, which can, in principle, be substituted for by other energy sources. Nobody will miss coal, if there is energy enough to collect from other sources.

Similarly, ordinary consumer goods are regularly exchanged and substituted for, and their value mainly depends on transitory needs and preferences. These are the kinds of resources whose destiny can be safely left to market mechanisms (or similar social devices) to determine.

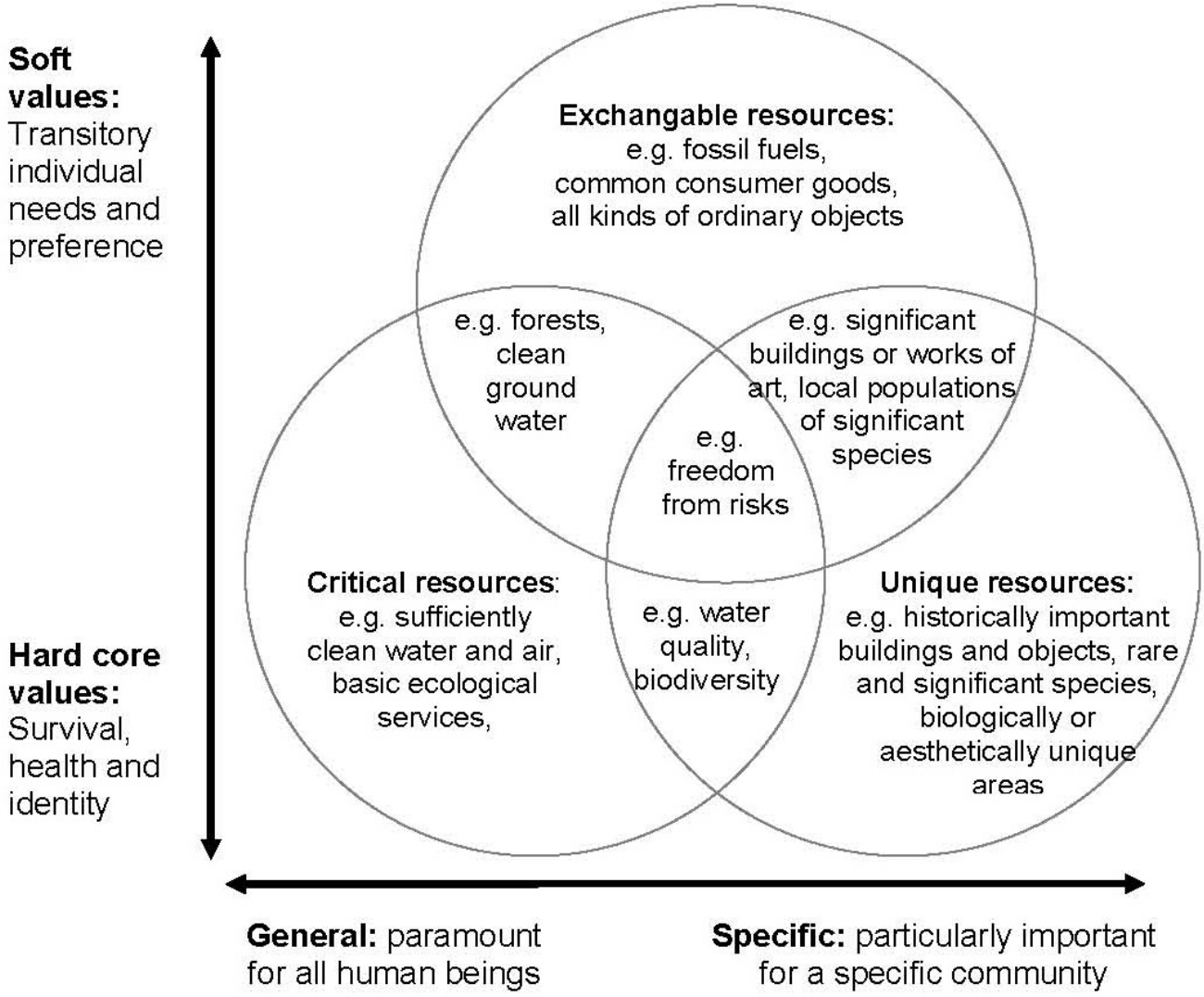


Figure 2. The three kinds of resources: exchangeable, critical, and unique.

Critical resources, on the other hand, are not so easy to do without, no matter which kinds of life style future generations are going to choose. Just like us, they will need sufficiently clean air and water as well as other basic resources, which are fundamental to human beings as biological creatures. The line between exchangeable and critical resources is a fuzzy one, however, because it remains an open question to what extent precaution needs to be taken. How clean is sufficiently clean, for instance? How many risks are we willing to take – or rather: let future generations take? These are to large extent cultural questions, and the answers very much depend on a specific culture's attitude towards risks and environmental quality.

Similarly, although it is possible to survive as biological creatures with a fairly limited amount of resources, it may not be possible to keep up the living standards of today. In this sense the identification of critical resources depends on which baseline living standard is chosen. It also very much depends on local circumstances, unless it is assumed that people should simply move away from a locality, when resources, which are critical for human life in this area, are consumed or otherwise damaged. Finally, if the well-being of (some) others species are included in the concept of sustainability (Dobson 1998), this would expand the number of critical resources significantly.

The third category of resources is unique resources. These are resources which are not indispensable for our survival as biological creatures, not even for a continuation of high living standards, but only for particular cultures' identity. They cannot be exchanged or substituted as simply as more ordinary things. Obvious examples are spectacular biological species or biodiversity in general, rare ecosystem-types, old and significant cultural creations, historically important sites, etc. Several of these are listed as heritage values on a local, national, or global level. Locally or nationally, there may also be a number of values, the fate of which is not left to be determined by private preferences. It may be decided, for instance, that preservation of clean ground water is considered to be so important for a specific community that it should not be submitted to pressure from market forces. This is the reason why it was decided in the U.S. of the early 70's not to use cost-benefit analysis before making policies related to the Clean Air Act, the Clean Water Act (Cropper and Oakes 1992, 675; Arrow et al. 1996, 4) as well as the Endangered Species Act (Nash 1989).

Again, there is no clear-cut line between the unique resources and two other kinds. Some resources are certainly more unique than others, and the precise list is inevitably going to change along with the cultural changes in general. However, the basic point is that the identification of unique resources is a common – cultural and political – task, where due respect ought to be given to inputs from experts and connoisseurs, not a consumer issue. It is more related to the question of who we are rather than to what we prefer to have (Sandel 1982, 180). This is exactly the reason why unique resources are so difficult to deal with in cost-benefit analysis.

Monetization may not be totally out of the question, though. If an attachment of economic value appears to be appropriate for some good reason, it should not be based simply on the individual's private preferences, however. Instead, it should be the result of a common deliberation about a particular community's priorities, where everybody behaves as a citizen, and not simply as a self-interested consumer (Sagoff 1998). It should reflect what the citizens or their (ideally: well-informed and virtuous) representatives have agreed to consider important – or made com-

promises about – after an open process of deliberation in a Habermasian spirit, not an aggregation of what isolated individuals may happen to wish for themselves. Even though it is likely that there will be a certain amount of disagreement, and procedural justice therefore becomes a separate issue (Miller 1999), it is basically not a question about the quantity of supporting persons or feelings, but about the quality of supporting arguments. What is important, too, is to realize that this kind of valuation cannot be made once and for all; inevitably, it will change with the circumstances.

The distributive problem

Distribution within generations

As we saw in the previous chapter, cost-benefit analysis relies on the potential Pareto-improvement rule stating that policies and projects should be adopted if and only if the net benefits are positive, or, in accordance with the Kaldor/Hicks criterion, if and only if those who are likely to gain from it can be expected, in principle, to be able to compensate those who are likely to lose, and still be better off than before.

The potential Pareto-improvement rule and the Kaldor/Hicks criterion both appear quite appalling. How can the potential compensation of victims be used as a justification, if the victims are not actually compensated? There is also a great amount of build-in conservatism in cost-benefit analysis. Due to the fundamental and sovereign criterion of potential Pareto-improvement, status quo, the existing equilibrium is used as baseline, no matter how inequitable this may seem. If, to use an extreme example, a society is dominated by a few very rich companies or individuals, due to some dim occurrences in the past, whereas the rest of the population live in extreme poverty, a cost-benefit analysis would recommend a project which made the oligarchs so much richer that they could, in principle, compensate the losers among the poor people. Whatever happened before the present situation is considered as “sunken” costs and benefits and not included in the calculation.

The potential Pareto-improvement rule and the Kaldor/Hicks criterion are usually defended by the following arguments (cf. Boardman et al. 1996, 32f). Firstly, when society as a whole becomes richer the worst off members of society are likely to benefit. Even if a more unequal distribution results from using the rule in a certain case, the poorest members of society will still be better off than they would have been without this application. If a more equal redistribution is wished for, this will be easier to accomplish separately when society becomes richer.

Secondly, different distributions will typically result in different sets of winners and losers, and if the economy as a whole grows due to the use of the potential Pareto-improvement rule, there will be more places where one can win. The average agent is an obvious winner, but even poor people can be expected to be able to improve their situation.

Thirdly, if actual compensations should be provided in detail from every winner to every loser, this would result in huge transaction costs. In most cases they do not know each other, and typically it is not even obvious who is affected, neither ex ante nor ex post, due to unclear lines of causality, uncertainty about the baseline case, etc. A vast bureaucracy would be needed in order to record not only each and every single cost and benefit separately but also exactly where, when, and on whom they fall, and to guarantee that the transfers were actually carried out.

These are all quite reasonable arguments under certain circumstances. Their validity depends, first of all, on the actual presence of welfare regulations that deals with serious distributive consequences otherwise (Campen 1986, 40). This is not always the case, of course. So, even though, theoretically, everybody may have a better chance of improving his or her situation when the economy is thriving, it is still necessary to give decision-makers a clear picture of where the costs and benefits are landing. After all, cost benefit analysis cannot abolish the rights of citizens, including private property rights, and compensation claims are often unavoidable.

In cross-national settings, where no regular compensatory mechanisms are operational, the use of the potential Pareto-improvement criterion becomes even more controversial. If all impacts of a certain project are placed in poor countries, where costs - including "statistical lives" – are cheap, while all benefits are moved to members of rich countries, this may be an improvement when measured in economic terms, but would appear offending in most people's opinion.

Even when no-one's legal rights are threatened by a project or policy, it is still important to identify winners and losers. If, for instance, disproportionately high costs of a project or policy are borne by a limited group of people, maybe even some of the worst off people in society, this would in itself be a good reason for changing or rejecting the project or policy. This is also reflected in the economic assessment guidelines of the U.S. OMB and EPA (U.S. OMB, 16; U.S. EPA, Chp. 9) as well as in the U.K.

Treasury Green Book, although none of these recommend a specific methodology. Both sets of guidelines are open for the possibility that various groups or sub-populations are weighted differently in impact assessment analyses, on the basis of separate equity assessments. Local costs and benefits, or costs and benefits falling on particularly disadvantaged people, for example, may thus be given more weight in the account. The identification and definition of relevant sub-groups is not an easy job, though, as can be seen, for instance, in the attempt to set up a framework in the U.S. EPA Guidelines.

It does not always make a case better, if real (instead of potential) Pareto-improvement is used as criterion. Sometimes this may actually worsen things. The reason is that questions of equity typically are ignored in cost-benefit analysis. For instance, in some assessments of what would count as reasonable policy reactions to the increasing greenhouse effect it is assumed that status quo and 'normal' economic development function as baseline for negotiations. In this case any cut in the use of fossil fuels in order to slow climate change would hurt countries like Saudi Arabia, USA, Russia or China with large deposits of oil, gas, or coal.

According to the actual Pareto-improvement scheme these countries should be compensated for their losses – as is often the case when agreements are international (Azar 2000). Who should compensate them, then? The winners, of course. Who are they? Those countries, or individuals, who benefit from the abatement, i.e., the poorest people who do not have enough economic and technological means to avoid the negative impacts of an increasing greenhouse effect.

Another distributive problem related to cost-benefit analysis is that willingness to pay is depending on ability to pay. Wealthy people's wishes count more than poor people's wishes. The standard justification is, firstly, that this just reflects the situation on the market, which cost-benefit analysis is supposed to imitate. If this is not equitable, it has to be

dealt with otherwise. Secondly, as Alfred Marshall pointed out, in many cases the sheer number of people influencing the market situation tends to diminish the influence of particular groups (Marshall 1920/1946, 19).

Still, it is necessary to assess whether this argument is applicable in each particular case. This leaves us once again with two ways to deal with the problem in relation to cost-benefit analysis. Either one can argue that cost-benefit analysis should not pay much attention to this problem, but stick to its standard methodology and leave it to the decision-makers to take care of the problem otherwise, or one can insist that this concern should be reflected explicitly in the analysis, for instance, by "valuing the poor individual's extra dollar higher than the rich individual's" (Toth, 132).

Distributions across generations

There are several issues where the gainers and the losers, the tortfeasors and the negatively affected parties, are situated in different generations. The increasing greenhouse effect is the most obvious example, but there are many others: irreversible losses of biodiversity, radioactive waste from nuclear plants, losses of non-renewable resources like fossil fuels, ground water pollution, etc.

It is worth noticing that when we are talking about equitable distribution across generations it no longer makes sense to use the homo economicus construct exclusively as starting point. If everybody acted as egocentric busybodies only looking for mutual advantage contracts, future generations would be the first to loose (Barry 1989, 189ff). They will never be able to do anything for us, nor will they ever be able to harm us in any serious way. It has been argued, though, that the relation between generations can be conceived of as a contract involving three currently living and equally selfish generations (Gauthier 1986), and that the different generational interests would balance each other in a way similar to the equilibrium of opposing interests on the market. However, if everybody really were as selfish as it is assumed in economic calculations, it would be quite obvious to drop all obligations to future people a number of generations away. In this case it would be easy to ignore problems that could be kept away for a certain amount of time.

According to Layard & Glaister this is actually the position of most economists, who are only willing to judge projects in terms of present welfare effects. Layard and Glaister themselves support the opposite view that cost-benefit analysis "aims to throw light on what is right," and, accordingly, cannot find any excuse for ignoring future generations (Layard & Glaister 1996, 33). A parallel distinction can also be found in the chapter on intertemporal equity and discounting in the IPCC Working Group III report from 1996 (Arrow et al. 1996): the "descriptive" approach begins with evidence from actual decisions, whatever ethical positions these may happen to express, whereas the "prescriptive" approach begins with ethical considerations. This way of constructing the difference is somewhat confusing, however, because the so-called descriptive approach actually does take a specific ethical stance. It is simply using the potential Pareto-improvement criterion in a cross-generational context, despite the obvious lack of direct compensatory mechanisms. In general, the supporters of this approach are assuming that a continuous economic growth will be in the interest of future generations as well.

All differences apart, all parties do agree that future costs and benefits should not count as much as current ones. Future net benefits should be discounted in order to find the net present value. Estimated future costs and

benefits are accordingly decreased in current calculations by a discount factor $1/(1+r)^t$ where r is the discount rate and t is a time index.

Several reasons have been put forward in defence of this claim. Firstly, it is obvious that somehow we have to reduce the influence of future consequences on current decisions. Otherwise, the sheer weight of costs and benefits of an infinite or at least extremely vast number of future people may happen to be so colossal that impacts on present generations would count next to nothing, and the required savings rate would become absurdly high (Arrow 1999).

By discounting future impacts, current people's interests become more visible in the calculation. Discounting all kinds of future consequences without differentiation is a way too high prize to pay on this account, however. After all, one of the basic points in "doing the right thing" in relation to future generations is to avoid reducing the spectrum of attractive opportunities in order to keep up the possibility of welfare (or a good life) for time to come. This point is totally blurred if all future consequences are discounted on an equal basis. Likewise, equity across generations does not demand that the current generation's needs are sacrificed, but only that different generations have comparable opportunities.

Secondly, it is assumed that people in general prefer to have current needs and wants satisfied rather than those they may have in the future. People are believed to be so impatient that they are not willing to save as much for the future as a cool calculation would advise them to do. This is usually referred to as the pure time preference argument, and is often transferred from the individual level to society at large. For example, the U.K. Treasury refers to it in the following naïve way: "Society as a whole (sic!) prefers to receive goods and services sooner than later, and to defer costs to future generations" (U.K. Treasury 2000, 26). The pure time preference argument is not convincing even for individuals. Of course there are individuals with a short planning horizon, or people who believe that their self at time t_0 is so different from the future self at time t_1, that this is actually a different person, whom the self at t_0 only feels partly responsible for. But from a societal point of view, why should the person's needs (or preferences) at t_1 be less important than the person's needs at t_0? The argument loses all credibility in the case of cross-generational distribution, where costs and benefits fall on different sets of people no matter how much they are considered as part of the same "society as a whole."

Thirdly, and this is a far more compelling argument, technological improvement and economic growth in society is likely to make people richer in the future, at least in the near future, and at least in terms of consumer goods. If future people are expected to be richer than we are, it does not seem equitable that we should use large sums to improve their welfare further, for instance, by avoiding unfortunate environmental impacts. Moreover, if we could invest our money in projects that are more profitable, this may be to the advantage of future people, too.

Consequently, there should be some proportion in current people's effort; future people's costs should be seen in relation to their presumably higher income, which may be assumed also to result in a lower marginal utility of each extra gain (unless it is believed that future people are more difficult to satisfy due to more expensive tastes which current people ought to support). Future costs and benefits should be discounted, accordingly, at the expected rate of economic growth or growth of consumption (g) multiplied by the presumed elasticity of marginal utility (θ).

Notice that this argument, unlike the second one, is an argument from equity. It is also an argument, however, which is based on assumptions that may happen to be quite precarious. Whereas it is true that the general trend for several hundred years has been one of economic growth, it is no longer quite as obvious that this trend will continue to be dominant hundreds of years from now. After all, several of the key resources in the current period of exceptional economic growth have become more difficult to extract; fossil fuels being the primary case. Although science and technology can be expected to continue to improve, and thus to be finding new means and paths, the sheer size of an economy several times bigger than the current one makes the whole scenario rather incalculable – with an interest rate of 6 percent (quite common in cost-benefit calculations) we are talking about an economy some 18 times bigger then the current one within half a century. Not even a radical decoupling of economic and material growth would seem to suffice. Moreover, even though future people may happen to be wealthier in terms of consumer goods they may also be poorer in terms on non-monetised goods. The argument thus assumes that each and every good can be substituted for by something else.

Fourthly, it can be argued that current people care less and less about future people the further away these people live, because we know less and less about who they are and what they cherish. In the long run, our effort to improve the conditions of future people may not hit the target at all, because they may not share our values or preferences. The effort should therefore not have the same priority as efforts to help current people who can be asked about their needs and wants. People in the far future can be compared to people on the other side of the globe or to current people with a way of life very different from our own. There seems to be an empathetic distance. Discounting their costs and benefits could be seen as a reflection of our lack of interest due to the plausible diminishing compatibility of our and their cultural values.

This argument is supported by the fact that, in certain cases, a large part of the beneficiaries will be descendants of current people of the third world. There will be relatively more people in these countries in the future, and these people will be more vulnerable to climate change than future rich people in the industrialized countries. Policies of greenhouse gas mitigation, in particular, may thus be likened to foreign aid programs (Schelling 1999). If we do not give much support to poor people in other countries today, why should we support their probably somewhat richer descendants more thoroughly? If we actually want to make sacrifices in order to give more help to the poor people of the world, why not invest in immediate improvement instead? If this leads to economic development today, future people in these parts of the world would also be less vulnerable to climate change.

At least two arguments can be put forward against this kind of reasoning. The analogy between future people and current people with a different culture is misleading at one point: we are not directly responsible for the fate of current people in other parts of the world, whereas we do hold the destiny of future people in our hand. Responsibility matters. Moreover, we do have the possibility of influencing future culture to a larger degree than current culture in foreign countries. They may not be as foreign to us as the argument assumes, but should rather be seen as descendants of a common culture of argument. It should be noticed, also, that this line of argument is more suitable for communitarians (de-Shalit 1995) than for economists working in the neoclassical tradition, trying to reduce common values to private preferences. For them emphatic distance cannot be an issue,

and, consequently, no serious reason for discounting future costs and benefits.

A fifth reason given for discounting is that future costs and benefits are more uncertain. Unforeseeable events like war, natural disasters, etc. may happen to change the whole scheme. Likewise, if we do a lot for the far future, we cannot be sure that the generations in between will not do what mainstream economists expect them to do: look at their own advantage and let go of the generations further down the road. The further away in time we look the more probable is it that something will be happening in he meantime. Discounting may appear to be a solution to this problem, because it reflects the diminishing ability to foresee the situation of future people. A problem with this solution is that it confuses two separate issues: the risk of future benefits and the length of time until they materialize (U.S. EPA 2000, 37; Møller 2003). Not all current investments are equally risky, so this can hardly be the basis for the use of a general discount rate, which works from day one.

Short term discounting cannot be equalized with long term discounting. In the second case the use of even a modest discount rate will erase remote impacts from current accounts. For this reason several authors have suggested lowering the discount rate over the years until it is close to zero in the distant future (cf. several contributions in Portney & Weyant 1999; U.K. Treasury 2000). One problem with this approach is that it easily leads to the so-called time inconsistency problem: the discount rate would have to be changed every time a new planning process begins, and the rate in a new plan would necessarily contradict those in older plans. This does not appear to be too much of a problem, though. A more radical solutions would be to drop some of the basic assumptions in cost-benefit analysis altogether in relation to decision making in cases like the increasing greenhouse effect, where the most serious impacts can be expected to lie in the far future, and concentrate on the basic questions of equity instead (Lind & Schuler 1998).

The question of discounting is handled very unevenly by different institutions and analysts. The U.S. Office of Management and Budget recommends a discount rate of 7 percent (U.S. OMB 1992 and 1996), but in the latest draft of new guidelines they recommend to use a 3 percent rate as well (OMB 2003). The U.S. EPA recommends a general 2-3 percent rate for intra-generational discounting (equal to the historical records of the consumption rate of interest). It is also recommended that a 7 percent rate is used in sensitivity tests, together with a “no discounting scenario” (without value summation) in relation to inter-generational issues like the increasing greenhouse effect (U.S. EPA 2000, 48 and 52). The British Green Book recommends a short term (<30 years) discount rate of 3.5 percent, calculated on the basis of a) pure rate of consumption together with catastrophe risk: 1.5 percent, plus b) the annual growth in per capita consumption: 2 percent; in relation to long-term effects it is recommended to use a declining discount rate (U.K. Treasury 2000, 97ff). All of this is significantly lower than recommendations from previous Treasury guidelines. The ExternE-project recommends a 3 percent discount rate (using 0 and 10 percent rates in sensitivity tests), but uses other rates in certain situations (European Commission 1999, 64f). The Danish Ministry of Finance recommends a general discount rate of 6 percent (Finansministeriet 1999, Appendix C), based on estimates of the opportunity costs of capital, i.e., the missed potential returns from present alternative (private) investments. Reports from the Danish Ministry of the Environment, on the other hand, recommend a discount rate of 3 and 2 percent respectively, but it is also

recommended that projects should yield an effective dividend of at least 5 percent (Møller et al. 2000, Møller 2003).

The next question to turn up is this: should all costs and benefits be discounted at the same rate, or should some costs or benefits be treated separately? If future people are actually going to be as rich as it is assumed by analysts, who prefer a high discount rate, this will undoubtedly influence the combination of preferred goods. Let us assume, for the sake of argument, that people living a couple of hundred years from now are going to be ten (or more) times richer than current people (in industrialised countries), as the use of even a fairly low rate of interest would imply. In this case it seems quite absurd to think that they are simply going to want ten times as many cars, washing machines, and egg boilers as today. Even if we assume that ordinary resource shortages are not going to prevent them from having these items (and this may happen to be a shaky assumption), is seems quite obvious that the preferred combination of desired goods will change.

For instance, it seems likely that areas with a modest human impact and high biological diversity will be scarce in the future and therefore also economically valuable. This is a pattern already observed to some extent in current industrialised countries. Should this not be reflected in cost-benefit analysis, for example, by excluding these kinds of goods from discounting? The U.S. Office of Management and Budget recommends that these two issues are dealt with separately (U.S. OMB 1996, 12), whereas others recommend that scarce environmental goods are exempted from discounting (U.K. Treasury 2000, 25) – or even discounted at a negative rate.

Another issue which could be dealt with separately is potential losses of human lives. If we assume that these losses are monetised as "statistical lives," and that a discount rate of, say, 5 percent is used, one life lost today would count more than 100 lives lost a century from now. Methodology apart, it is not obvious at all what could make this right. Similarly, a foreseeable catastrophic event in the far future cannot be treated on a par with some minor welfare changes over a long period.

The choice of discount rate has significant impact on the assessment of long terms projects and policies. There is not one single rate which can be recommended without further qualification. In relation to intergenerational issues the choice is basically a matter of equity. When a high rate is chosen this is usually done on the basis of very optimistic assumptions about continuous economic growth and unlimited substitutability of resources – often combined with a lack of interest in the destiny of future people (disguised as a high "societal pure time preference"). On the other hand, the choice of a low rate (in general or in relation to specific goods) signals less optimism, more concern for futurity and/or for preservation of critical and unique resources. The use of several different rates (at least in sensitivity tests) designates that this is not a question which is appropriate for economists to deal with on their own.

Consumer sovereignty and the problem of "rational fools"

It is a basic assumption in cost-benefit analysis, as well as in welfare economics in general, that valuations should be based on preferences as they happen to be, or to be more precise: as they are revealed through the consumers' willingness to pay on the market. The consumer is considered sovereign, no

matter what he or she may happen to prefer. Preferences are treated as exogenous facts, not as preliminary assumptions which may be changed through experience and deliberation (Sagoff 1984, 1988 & 1996; Norton et al. 1998).

The rationality of economic man is thus limited to the ability to pursue arational goals the most efficient way, and does not include having the most well-considered values, goals and ambitions. Economic agents are treated as "rational fools" (to use Amartya Sen's phrase): their subjective preferences, expressed in their willingness to pay, are taken seriously, but not their agency, i.e., their status as presumably reasonable and reflective fellow human beings (Sen 1987, 15ff and 40ff; Sen 1997, 84ff).

The rationality of cost-benefit analysis is limited to calculations based on revealed preferences, and does not extend to considering the reasonableness of values, goals and ambitions of individuals. Neither welfare economics in general nor cost-benefit analysis are developing arguments concerning the good life. Most economists rely on the, basically deontological, principle of consumer sovereignty – typically without trying to construct a serious defense – although their consequentialist agenda actually force them to overrule the principle whenever there is even the smallest gain to achieve.

This is all very much in line with preference utilitarianism and to a large extent with the hedonistic utilitarianism of Jeremy Bentham. In a defence of utilitarianism John Stuart Mill did put forward a point, however, which has troubled sensitive utilitarians ever since: Utility is not simply a matter of quantity (number of happy feelings times intensity times duration), but also of quality. We have to admit, he wrote in a famous passage, that, after all, we do consider it better to be a dissatisfied Socrates than a happy pig (Mill 1861). There are actually two issues involved. Firstly, there is the problem whether the commodities we acquire actually help us in leading a good life. Secondly, there is the problem of selfishness: if economics endorse an image of man as a self-absorbed pleasure machine, then how about the so-called "higher" feelings towards fellow humans and other species? Both were issues that preoccupied the early neoclassical economists. All of them agreed with Mill on this particular point, and found it necessary to come up with a satisfying answer.

Let us begin with the first of the two issues. Jevons was quite explicit in his answer to Mill's challenge. Economy deals only with the "lowest rank of feelings," he wrote. It is a calculus of utility that aims only at supplying the "ordinary wants of man" at the least cost of labour (Jevons, 32). A certain "higher" kind of consideration is needed in order to determine how we may best employ our wealth for the good of others as well as ourselves. We do need the lower calculus, however, in order to achive "the utmost good in matters of moral indifference," i.e., where the higher calculus gives no prohibition (ibid.).

At the same time, however, we ought to be aware of a general tendency which the economist Senior had already by then named "the Law of Variety." When the necessities of life are few and simple, human beings are soon satisfied, and desire to extend their range of enjoyment. First they vary their food; later on they seek variety and elegance in dress, in buildings and ornament. In general, every satisfaction of "lower wants" creates new desires of a "higher character." The highest grade in the scale of wants, namely "pleasure derived from the beauties of nature and art, is usually confined to men who are exempted from all the lower privations" (Jevons, III.11). Economy is not in itself fit to deal with these matters, but it provides the

basis for the development of higher needs when guaranteeing that necessities are produced in the most efficient way.

Alfred Marshall argues along quite similar lines. He agrees with Aristotle that the highest good or the "fulness of life" lies in "the development and activity of as many and as high faculties as possible." A decent income earned by steady work is the proper foundation for this, because it helps one to develop the right kind of "habits of body, mind, and spirit." This is where economics are most helpful, because increases in wealth add to "the fulness and nobility of human life." As soon as the necessaries of life are provided, with a helping hand from economics, everyone can begin to, or rather: ought to seek to "increase the beauty of things in his possession rather than their number or their magnificence" (Marshall, 1920/1946, 136).

However, there does seem to be a threshold beyond which the satisfaction of "real wants" is threatened by the growth of a "desire for wealth as a means of display." Real goods are crowded out by the kinds of goods which Fred Hirsch much later labelled "positional" (Hirsch 1977). This is an echo of Aristotle and Rousseau, but also of Adam Smith, the moral philosopher warning against vanity and greed. The world would go much better, Marshall notices, if everyone were satisfied with "fewer and simpler things," and instead "take trouble in selecting them for their real beauty" (Marshall, 1920/1946, 136f). Beyond a certain point utility becomes mere ophelimity, economic welfare and happiness no longer walk hand in hand along the same path, and economics begin to loose credibility as the primary lever for the good life (cf. also Sagoff 1998, 220; O'Neill 1998, 53ff).

It is worth noticing that economists like Jevons, Marshall and Pareto thus apply a double standard. On the one hand, there are market values (or ophelimities) based on consumer preferences. On the other hand, there is the estimation of utility based on thorough reflection. Even though they believe that the two standards tend to converge due to the Law of Variety (or similar predispositions), this may not always be the case. Many public projects deal, directly or indirectly, with goods that many people may not be well acquainted with, such as, say, biodiversity and preservation of species in undisturbed areas. Or they may not be truly aware of the consequences of their choices. The question is, then, why people's preferences should be offered such a crucial role in decision making. After all, wouldn't we all favour a model where our well-considered and well-founded value judgments were represented rather than the preferences we simply happen to have for the time being? If so, those models should be chosen for decision making where everybody is offered a chance of refining their valuations through learning, discussion and deliberation. This is not the case in standard cost-benefit analysis.

The problem of social motives

In his Enquiry Concerning the Principles of Morals David Hume noticed that human beings, in spite of their apparent selfishness, often take an interest in the wellbeing of other people, even in the remotest cases: "A recent event or piece of news, by which the fate of states, provinces or many individuals is affected, is extremely interesting even to those whose welfare is not immediately engaged (…) The interests of society appears, on this occasion, to be in some degree the interest of each individual" (Hume 1751/1966, 58). For this reason he concluded that human beings, alongside their "self-love," have some kind of altruistic inclination, which leads them to act

in ways that are not selfish, sometimes even detrimental to their own interest. On the other hand, was Edgeworth not quite right when he pointed out that "The first principle of Economics is that every agent is actuated only by self-interest" (Edgeworth 1881, 16)? So the second issue is: how does cost-benefit analysis cope with the presence of what Mill called "higher" motives and with the fact that most people consider it to be not only meritorious, but often even obligatory to act on the basis of these "higher" motives?

Cost-benefit analysts often deal with this problem in two steps. The first step is to reduce the "higher" social motives to private preferences. If an individual finds the health or happiness of others important enough to influence his or her market behaviour, he or she simply reveals a preference for the wellbeing of others. It can thus be treated as yet another preference the intensity of which can be measured through the individual's willingness to pay. One need not even assume that the individual has a hidden selfish motive or a personal satisfaction from helping others – feeling the "warm glow" of doing good. It is enough just to say that there is a certain black box preference which is revealed through the individual's market behaviour.

Secondly, the very calculation made by economists, including cost-benefit analysis, is in itself the best way of acting in accordance with social motives, because it makes the satisfaction of preferences more Pareto efficient, and therefore improves total utility. Edgeworth, for instance, borrowed the distinction between egoistic and universal hedonism from Henry Sidgwick's Methods of Ethics (Sidgwick 1874), and distinguished between on the one hand economics, which "investigates the arrangements between agents each tending to his own maximum utility," and on the other hand politics and (utilitarian) ethics investigating "the arrangements which conduce to the maximum sum total of utility" (Edgeworth 1881, 6f and 15f). The two kinds of calculations is combined, however, in so far as the economic system can produce better results than any other system, when measured by ethical standards, in this case the standards of hedonistic utilitarianism.

These answers are not truly satisfying, however. The first part of the answer, the reduction of social motives to mere private preferences, involves an inappropriate blending of categories. People, who believe, for instance, that they ought to preserve reasonable living conditions for future generations, are acting in accordance with this belief, and not because they have some peculiar preference for the wellbeing of future people. 'Obligation' and 'preference' are not concepts placed on the same categorical shelf. Obligations do not even have to involve sympathy the way that Hume supposed. The obligation towards non-existing future generations shows this quite obviously. Nor can values be reduced to preferences (Sagoff 1986 and 1988; O'Neill 1993). Whereas preferences are basically subjective and accidental, values are inter-subjective and related to arguments.

The second part of the answer involves a contradiction in terms. If all social motives can be reduced to private preferences, why should economists' motives be any different? Many cost-benefit analysts actually do assume the presence of an obligation themselves, whenever they make their calculations, including calculations involving obligations towards posterity. As we have seen already, they are not content with referring to current people's preferences about future generations, but seriously discuss a variety of ethical reasons, which can be given for and against treating future needs on a par with current ones. When doing this, however, they also implicitly deny that people are simply "rational fools" trying to further their own pref-

erence satisfaction. If this were the case, the economists' inclusion of future needs would be an unjustified insertion of their own allegedly accidental and arational preferences for future people.

Cost benefit analysts easily end up with a similar contradiction in relation to political decisions. On the one hand it is assumed that cost benefit analysis can help making political decisions more rational. On the other hand political decisions are assumed to be mere expressions of arational preferences, which should simply be recorded along with all other kinds of preferences.

In order to avoid these contradictions, economists will have to accept – along with everybody else – that obligations and values cannot be treated as yet another set of preferences. As Pareto pointed out, the homo economicus, the self-regarding consumer, will have to be supplied by the more broad-minded homo ethicus and, consequently, the homo politicus, the citizen concerned with the public good and the values and obligations related to this (cf. also Faber et al. 2002). This will affect cost-benefit analysis seriously, both empirically and methodologically. If it is realized that people seriously try to act in accordance with ethical standards, it will lead to empirical failures to treat them simply as selfish consumers in all affairs. Similarly, the methodology of cost-benefit analysis will have to be adjusted in order to take ethical questions seriously as such.

We have already seen that the consumer model gets into trouble when dealing with critical and unique resources. The intuitive sense of this very much explains why many respondents in contingent valuation tests feel quite uncomfortable when "struggling with this money business" (Clark et al. 2000; cf. also Diamond & Hausman 1994). In particular, they question the idea that the social value of a non-marketed good, in this case a wildlife area, is depending on their own rather unreflected opinions and preferences, as well as the implicit assumption that this can form a proper basis for decisions about its future.

The use of cost-benefit analysis

Cost-benefit analysis is grounded methodologically in the private society conception, which sees society as a mutually beneficial aggregation of private consumers who all try to maximize the satisfaction of their own preferences, whatever these may happen to be. The market is the basic model for social relations, and interventions in the market are not appropriate, unless some kind of failure appears, which cannot be dealt with otherwise. Even in these cases the market should be imitated as far as possible. The common good should be conceived of as nothing but the good of all, to use Rousseau's famous phrase (Rousseau 1754/1974).

However, society is something else, too. It is just as much a union of unions (families, associations, communities, nations, etc.) working together in a common effort to further the good life, the identification and refinement of which is one of society's main tasks. Commitment, equity, and quality are key concepts here. Seen from this angle the market is only one out of a number of types of social organisations, each of which is appropriate for a specific set of purposes. Like any other kind of social organisation, it is in need of a permanent evaluation and justification. It has its strengths, but also a series of weaknesses, wherefore it should be kept within proper confines. Wherever it can be shown to further the good life it should be applauded; wherever not it should be limited in a reasonable way.

In the first conception, the private consumers (or should we rather say: their self-regarding preferences) are always considered sovereign – even in cases that cannot be dealt with properly by the market. Where markets fail, cost-benefit analysis moves in and estimates what would happen if, contrafactually, the market mechanisms were capable of doing their normal job.

In the second conception, the primary agents in social affairs are the citizens, who are expected to take the viewpoint of society at large throughout their deliberations. According to this second conception one of the citizens' most important regular tasks is, in general as well as in each particular case, to identify the borders between what must be considered private and social affairs respectively.

Some cost-benefit analysts tend to believe that the private society conception is an altogether adequate image. Most analysts do seem to be aware of several of its shortcomings, however, but consider it to be a reasonable proxy, which can be used methodologically to enlighten and improve citizens' and decision makers' treatment of complex issues. They recognize the need to take into consideration other concerns, which cost-benefit analysis is not suited to deal with, but insist that many issues can be treated much more systematically by means of economic analysis.

Even in cases, where impacts are difficult to monetise, cost-benefit analysis can deliver a framework, which makes it possible to deal with these issues in a systematic way. The U.S. EPA, for instance, argues in the following way: "Benefit-cost analysis is not a precise tool that yields firm numerical results, rather, it is a general framework for more carefully accounting for the potential and varied effects of government programs. Some of these effects can be quantified, whereas others can only be assessed qualitatively. Some may be relatively certain, whereas others may be quite speculative" (U.S. EPA 2000, 33). Despite all its weaknesses, the analysis does contribute to the decision making process by way of its methodological grip on most significant components of an issues.

On the other hand, critics do have a number of serious objections against the growing use of cost-benefit analysis in decision making, several of which have already been mentioned.

- A basic problem is the confusion of consumers and citizens. Social affairs are treated as private affairs. Political decisions are treated as if they were market decisions.
- Due to factors like lack of information, fallacies and misconceptions, self deception, lack of clarity about goals and measures, individual preferences are seldom clear, continuous, or well-founded. Yet they are regarded as the sole basis for cost-benefit evaluations.
- On the market decisions are taken individually in a series, not collectively in a group (to use Sartre's expressions). This often leads to problems of sub-optimality, as is well-known from examples like the prisoners' dilemma. Yet it is assumed in cost-benefit analysis that common decisions are aggregations of individual decisions.
- Non-marketed goods are monetised, even though several of these goods are kept away from the market deliberately, as is the case with human lives and unique resources.
- Equity issues are to a large extent ignored in cost-benefit analysis. This is the case with the baseline scenario as well as with the distribution of impacts. The institutional setup, which determines how the market

works, is beyond critique. Wealthy persons' wants count more in cost-benefit analysis than those of poor people.
- Cost-benefit analysis is unreliable in long term predictions due to the changes in valuation occurring along with the alteration of the situations in which the valuations occur.
- All too often basic assumptions are hidden in a methodological framework, which is not easily seen through if one is not familiar with economic analysis.
- The scientific and quantitative presentation is seductive and deceptive, because it signals a higher degree of certainty than cost-benefit analysis can actually achieve.

As we have seen above, some of these problems can be reduced in various ways. Assumptions can be stated more explicitly. More emphasis can be put on sensitivity tests. Uncertainties can be underlined. Qualitative components can be integrated in the analysis. Problems of equity can be given a more prominent position. Yet some of the basic problems cannot be dealt with this way.

Many economists argue that it is inappropriate to criticise the use of cost-benefit analysis by comparing it with an idealised democracy, where everybody's voice is heard equally, everybody yields to the best argument, etc. (cf., for instance, Boardman et al. 1996, 46; Turner 1979). Firstly, they point out, this is not how actual governmental processes works. The powerful interest groups are the ones who are listened to; power all too often overrules arguments. Cost-benefit analysis reveals the interests of less powerful groups and includes them in decision making procedures.

Secondly, even though each individual's preferences are seldom clear, consistent, and well-founded, the large number of people's preferences included in the analysis tends to make up for this. What cost-benefit analysis can do is to give important hints to decision makers about proportions and priorities. If conclusions are fairly clear, even after a sensitivity test has been made, this is in most cases a very good indication that the case in well-founded.

Thirdly, even though monetisation of externalities is shaky business, it is important to include these estimates, because otherwise environmental benefits are easily forgotten. Without economic values on non-marketed goods, only the (often: high) costs of preserving goods like nature sites or reducing health risks are left in the quantitative part of the account. And accounts in monetary quantities often appear more convincing to policy makers than qualitative descriptions of phenomena, the importance and proportion of which can be difficult to estimate.

Finally, cost-benefit analysis has much less influence on decision making than the critics assume. It is difficult to identify just one decision made solely on the basis of cost-benefit analysis. Cost-benefit analysis should be considered as one among several tools, which decision makers can use. Other concerns may overrule the results of cost-benefit analysis, or other tools may be more adequate in certain situations.

This brings us right back to Aristotle. Methodology cannot replace ethical judgment. In the end ethical and political decisions have to be made on the basis on many at least partly incommensurable factors. Cost-benefit analysis can often improve decision making due to its systematic treatment of the issue at hand. This is particularly true in relatively limited cases, which mainly include goods that are traded on markets. One needs to be very careful about its use, however, and even more so in more comprehensive cases, which involve several non-marketed costs and

benefits, or where long time impacts play an important role. Cost-benefit analysis can be very seductive, indeed, and one of the main virtues a decision maker needs to have is to be resistant to its magic.

References

Aristotle: *Nicomachean Ethics*, ed. David Ross, London: Oxford University Press 1954.

Aristotle: *The Politics*, ed. T.A. Sinclair, Harmondsworth: Penguin 1962.

Arler, Finn: "Distributive Justice and Sustainable Development," in: M.K. Tolba (ed.): *Our Fragile World: Challenges and Opportunities for Sustainable Development*, Oxford: EOLSS/UNESCO 2001.

Arler, Finn: "Ecological utilization space - operationalizing sustainability," in: Andrew Light & Avner de-Shalit (eds.): *Moral and Political Reasoning in Environmental Practice*, Cambridge, Mass.: MIT Press 2003.

Arrow, Kenneth J.: "Intertemporal Equity, Discounting, and Economic Efficiency," in: James P. Bruce, Hoesung Lee & Erik F. Haites (eds.): *Climate Change 1995. Economic and Social Dimensions of Climate Change*, IPCC/Cambridge University Press 1996.

Arrow, Kenneth J.: "Discounting, Morality, and Gaming," in: Portney & Weyant 1999, 13-21.

Arrow, Kenneth, Robert Solow, Paul R. Portney, Edward E. Leamer, Roy Radner & Howard Schuman: "Appendix I: Report of the NOAA Panel on Contingent Valuation," excerpt from Department of Commerce, National and Atmospheric Administration: "Natural Resource Damage Assessment Under the Oil Pollution Act of 1990" (1993), reprinted in: Harberger & Jenkins 2002.

Azar, Christian: "Economics and Distribution in the Greenhouse," in: *Climate Change* 47: 233-238, 2000.

Barry, Brian: *Theories of Justice*, London: Harvester-Wheatsheaf 1989.

Bentham, Jeremy: *An Introduction to the Principles of Morals and Legislation* (1789), eds. J.H. Burns, H.L.A. Hart & F. Rosen, Oxford: Clarendon Press 1996.

Boardman, Anthony E. et al.: *Cost-Benefit Analysis: Concepts and Practise*, Upper Saddle River, NJ: Prentice Hall 1996.

Campen, James P.: *Benefit, Cost, and Beyond*, Cambridge, Mass.: Ballinger Publishing Company 1986.

Caulfield, Jr., Henry P.: "Early Federal Guidelines for Water Resource Evaluation," in: *Journal of Contemporary Water Research and Education* 116, 2000: 14-17.

Chiesura Anna, Rudolf de Groot: "Critical natural capital: a socio-cultural perspective", in: *Ecological Economics* 44, 2003: 219-31.

Clark, Judy, Jacquelin Burgess & Carolyn M. Harrison: "'I struggled with this money business': respondents' perspectives on contingent valuation," in: *Ecological Economics* 33, 2000: 45-62.

Dahl, Robert A.: *Democracy and its Critics*, Cambridge, Mass.: Yale University Press 1989.

De Groot, Rudolph, Johan Van der Perk, Anna Chiesura & Arnold van Vliet:

"Importance and threat as determining factors for criticality of natural capital," in: *Ecological Economics* 44, 2003: 187-204

De-Shalit, Avner: *Why Posterity Matters*, London: Routledge 1995.

Diamond, Peter & Jerry A. Hausman: "Contingent Valuation: Is Some Number better than No Number?" in: *The Journal of Economic Perspectives* 8 (4), 1994: 45-64.

Dobson, Andrew: *Justice and the Environment*, Oxford University Press 1998.

Dupuit, Arsène-Jules-Étienne-Juvénal: "On the measurement of the utility of public works" (1844), in: *International Economic Paper no.* 2, London & New York: Macmillan 1952.

Edgeworth, F.Y.: *Mathematical Physics. An Essay on the Application of Mathematics to the Moral Sciences*, London: C. Kegan Paul 1881.

Ekelund, Robert B. Jr. & Robert F. Hébert: *Secret Origins of Modern Microeconomics. Dupuit and the Engineers*, Chicago & London: University of Chicago Press 1999.

Ekins, Paul, Sandrine Simon, Lisa Deutsch, Carl Folke, Rudolph De Groot: "A framework for the practical application of the concept of critical natural capital and strong sustainability," in: *Ecological Economics* 44 (2003): 165-85.

Ekins, Paul: "Identifying critical natural capital. Conclusions about critical natural capital," in: *Ecological Economics*, 44, 2003: 277-292.

Epicurus: "Letter to Menoeceus," "Principal Doctrines," "Fragments," in: *The Epicurus Reader: Selected Writings and Testimonia*, transl. & edit. Brad Inwood and L.P. Gerson, Indianapolis: Hackett Publishing Company 1994.

European Commission: *ExternE - Externalities of Energy. Vol. 7: Methodology 1998 update*, European Commission 1999.

European Commission: *Recommended Interim Values for the Value of Preventing a Fatality in DG Environment Cost Benefit Analysis*, EU Commision 2001, http://europa.eu.int/comm/environment/enveco/others/recommended_interim_values.pdf.

Faber, Malthe, Thomas Petersen & Johannes Schiller: "Homo oeconomicus and homo politicus in Ecological Economics," in *Ecological Economics* 43, 2002: 323-333.

Finansministeriet (Danish Ministry of Finance): *Vejledning i udarbejdelse af samfundsøkonomiske konsekvensvurderinger*, København: Finansministeriet 1999.

Gauthier, David: *Morals by Agreement*, Oxford University Press 1986.

Hanemann, W. Michael: "Valuing the Environment Through Contingent Valuation," in: *Journal of Economic Perspective* 8 (4), 1994: 19-43.

Harberger, Arnold C. & Glenn P. Jenkins (eds.): *Cost-Benefit Analysis*, Cheltenham/ Northampton, MA: Edward Elgar Publishing 2002.

Hirsch, Fred: *Social Limits to Growth*, London: Routledge and Kegan Paul 1977.

Hirschman, Albert O.: *The Passions and the Interests. Political Arguments for Capitalism before Its Triumph*, Princeton, New Jersey: Princeton University Press 1977.

Hobbes, Thomas: *Leviathan* (1651), ed. C.B. MacPherson, Harmondsworth: Pelican 1968.

Holland, Alan: "Substitutability: Or, Why Strong Sustainability is Weak and Absurdly Strong Sustainability is Not Absurd," in: J. Foster (ed.): *Valuing Nature? Economics, Ethics and the Environment*, London: Routledge 1997.

Holland, Alan: "Sustainability: Should We Start from Here?" in: Andrew Dobson: *Fairness and Futurity*, Oxford University Press 1999.

Hufsmith: "Benefit-Cost Analysis: 1933-1985," in: *Journal of Contemporary Water Research and Education* 116, 2000: 42-49.

Hume, David: *An Enquiry Concerning the Principles of Morals* (1751), La Salle, Illinois 1966.

Hume, David: *A Treatise of Human Nature* (1748).

Jevons, William Stanley: *The Theory of Political Economy*, London: Macmillan and Co. 1871.

Jevons, William Stanley: *The Theory of Political Economy*, Third Edition, London: Macmillan and Co. 1888.

Kant, Immanuel: *Grundlegung zur Metaphysik der Sitten* (1785), ed. K. Vorländer, Hamburg: Felix Meiner Verlag 1965.

Kneese, Allen V.: "Whatever Happened to Benefit-Cost Analysis?" in: *Journal of Contemporary Water Research and Education* 116, 2000: 58-61.

Layard, Richard & Stephen Glaister (eds.): *Cost-Benefit Analysis*, Cambridge University Press 1994.

Lind, Robert C. & Richard E. Schuler: "Equity and Discounting in Climate Change Decisions," in: Nordhaus 1998.

Little, I.M.D.: *Ethics, Economics & Politics*, Oxford University Press 2002.

Andreas Löschel: "Technological change in economic models of environmental policy: a survey," in: *Ecological Economics*, 43, 2002: 105-126.

Marshall, Alfred: *Principles of Economics*, 1890, 1920[8], London: Macmillan 1946.

Mill, John Stuart: *Utilitarianism* (1861).

Miller, David: "Social Justice and Environmental Goods," in: Andrew Dobson: *Fairness and Futurity*, Oxford University Press 1999.

Møller, Flemming et al.: *Samfundsøkonomisk vurdering af miljøprojekter*, København: Danmarks Miljøundersøgelser, Miljøstyrelsen, Skov- og Naturstyrelsen 2000.

Nash, Roderick Frazier: *The Rights of Nature. A History of Environmental Ethics*, Madison: University of Wisconsin Press 1989.

Nordhaus, William D. (ed.): *Economics and Policy Issues in Climate Change*, Washington D.C.: Resources for the Future 1998.

Norton, Bryan, Robert Costanza, Richard C. Bishop: "The evolution of preferences. Why 'sovereign' preferences may not lead to sustainable policies and what to do about it", in: *Ecological Economics* 24, 1998: 193–211.

O'Neill, John: *Ecology, Policy and Politics*, London & New York: Routledge 1993.

O'Neill, John: *The market*, London & New York: Routledge 1999.

Pareto, Vilfredo: *Manual of Political Economy* (1909, 1927), London and Basingstoke: MacMillan 1971.

Pearce, David: *Environmental values and the natural world*, London: Earthscan 1993.

Pearce, David: "Cost-Benefit Analysis and Environmental Policy," in: *Oxford Review of Economic Policy* 14 (4), 1998: 84-101.

Pearce, David: "Valuing Risks to Life and Health," Paper prepared for the European Commission (DGXI) Workshop on Valuing Mortality and Valuing Morbidity, Brussels 2000 http://europa.eu.int/comm/environment/enveco/others/david_pearce_paper.pdf.

Pearce, David & Dominic Moran: *The Economic Value of Biodiversity*, London: Earthscan/IUCN 1994.

Pearce, David & R. Kerry Turner: *Economics of Natural Resources and the Environment*, New York/London: Harvester Wheatsheaf 1990.

Pigou, A.C.: *Wealth and Welfare* (1912), Collected Economic Writings Vol. 2, Houndsmill/London: Macmillan Press Ltd. 1999.

Popper, Karl: *The Open Society and its Enemies*, Vol. 1-2, 5. edition, Routledge and Kegan Paul 1974.

Portney, Paul R.: "The Contingent Valuation Debate: Why Economists Should Care," in: *Journal of Economic Perspectives* 8 (4), 1994: 3-17.

Portney, Paul R. & John P. Weyant (eds.): *Discounting and Intergenerational Equity*, Washington D.C.: Resources for the Future 1999.

Rawls, John: *A Theory of Justice*, Oxford University Press 1973.

Rousseau, Jean-Jacques: *The Social Contract* (1754), ed. Maurice Cranston, Harmondsworth: Penguin 1974.

Sagoff, Mark: "Values and preferences," in: *Ethis* 96 (2), 1986: 301-16.

Sagoff, Mark: *The economy of the earth*, Cambridge: Cambridge University Press 1988.

Sagoff, Mark: "Should Preferences Count?" in: *Land Economics* 70, 1994 (2): 127-144.

Sagoff, Mark: "Aggregation and deliberation in valuing environmental public goods: A look beyond contingent pricing", in: *Ecological Economics* 24, 1998: 213–230.

Samuelson, Paul R.: *Economics. An Introductory Analysis*, New York, Toronto, London: McGraw-Hill 1948.

Sandel Michael J.: *Liberalism and the limits of justice*, Cambridge University Press 1982.

Sen, Amartya: *On Ethics and Economics*, Oxford: Blackwell 1987.

Sen, Amartya: *Choice, Welfare and Measurement* (1982), Cambridge, Mass.: Harvard University Press 1997.

Sidgwick, Henry: *The Methods of Ethics*, London: MacMillan & Co. 1874.

Smith, Adam: *The Theory of Moral Sentiments* (6. edit. 1790), eds. D.D. Raphael & A.L. Macfie, Oxford: Clarendon Press 1976.

Smith, Adam: *Inquiry into the Nature and Causes of the Wealth of Nations* (1776), ed. A. Skinner, Harmondsworth: Penguin 1974.

Solow, Robert M.: ”Sustainability: An Economist's Perspective,” in: R. Dorfman & N.S. Dorfman (eds.): *Economics of the Environment. Selected Readings*, New York: W.W. Norton & Company 1993.

Schelling, Thomas: “Intergenerational Discounting,” in: Portney & Weyant 1999, 99-101.

Turner, R.K.: “Cost-Benefit Analysis – a Critique,” in: *OMEGA The Int. Jl. Of Mgmt. Sci.* 7 (5), 1979: 411-419.

Turner, R. Kelly, Jouni Paavola, Philip Cooper, Stephen Farber, Valma Jessamy, Stavros Georgiou: “Valuing nature: lessons learned and future research directions,” in: *Ecological Economics* 46, 2003: 493-510.

Viscusi, W. Kip & Joseph E. Aldy: “The Value of a Statistical Life: A Critical Review of Market Estimates Throughout the World,” in: *The Journal of Risk and Uncertainty* 27 (1), 2003: 5-76.

U.K. Treasury: *The Treasury Green Book*, 2000
www.hm.treasury.gov/uk/pdf/2000/
greenbook.pdf.

U.S. Environmental Protection Agency (EPA): *Guidelines for Performing Regulatory Impact Analysis*, 1983 (/1991, including Appendices A-D) www.epa.gov/economics.

U.S. Environmental Protection Agency (EPA): *Guidelines for Preparing Economic Analysis*, 2000 www.epa.gov/economics.

U.S. Environmental Protection Agency (EPA): *Regulatory Economic Analysis at the EPA*, 2003 www.epa.gov/economics.

U.S. Environmental Protection Agency (EPA): *Environmental Economics Research at the EPA*, 2004 www.epa.gov/economics.

U.S. Office of Management and Budget (OMB): *Circular A-94 Revised*, October 29, 1992 www.whitehouse.gov/omb.

U.S. Office of Management and Budget (OMB): *Economic Analysis of Federal Regulations Under Executive Order 12866*, January 11, 1996 www.whitehouse.gov/omb.

U.S. Office of Management and Budget (OMB): *Draft 2003 Report to Congress on the Costs and Benefits of Federal Regulations*, February 3, 2003 www.whitehouse.gov/omb.

Vejdirektoratet: *Trafikuheldsomkostninger 1999*, Rapport 204.
Copenhagen: Vejdirektoratet 2001
www.vejdirektoratet.dk/pdf/rap204.pdf.

About the author

Finn Arler
Finn Arler has a Ph.D. in Philosophy from Aarhus University, and he is associate professor in Human Ecology at Aalborg University. He has written a number of articles about issues related to human ecology and environmental ethics. He has edited several books, the latest of which is a textbook in Human Ecology.

Particularly during the latest couple of decades, cost-benefit analysis has become a central tool in decision making related to environmental issues. The purpose of this research report is threefold.

Firstly, the author traces the origins and justification of cost-benefit analysis in moral and political philosophy.

Secondly, he explain some of the basic features of cost-benefit analysis as a planning tool in a step-by-step presentation.

Thirdly, he presents and discusses some of the main ethical difficulties related to the use of cost-benefit analysis as a planning tool.