Research Memoranda

Sustainable Development and Paradigms in Economics

Hans Opschoor

Research Memorandum 1994-30

august 1994

vrije Universiteit *amsterdam*

SUSTAINABLE DEVELOPMENT AND PARADIGMS IN ECONOMICS

Hans Opschoor

" The greatest common property that we have is the earth itself "
Takashi Fujii 1992

I Introduction

This paper presents an attempt to relate a number of paradigms or perspectives in economics to the notion of 'sustainable development' (SD) and how this notion is (to be) operationalised.

Several economic paradigms have emerged from classical economics as it was practiced in the past century (or "political economy" as it was then called), especially: neoclassical economics (the "mainstream"), institutional/evolutionary economics (and some other forms of post-classical political economics). After looking at the main features of some of these paradigms we shall ask if and where they fail and whether and how that could be remedied.

What SD is, or has been taken to be, is discussed in section 2; the paradigms and their views on SD are given in 3; in section 4 I shall try to show some implications in terms of what these views mean for the choice of performance indicators on the economy-environment interface, and in terms of instruments recommended for environmental or sustainable development policies.

II Sustainable Development as a Challenge

II.1 Sustainable Development

'Sustainable development'(SD) is proposed as a guiding principle for economic development planning (IUCN 1980, WCED 1987, UNCED 1992) in both developing and industrialised countries. Its most widespread definition is: development that satisfies present needs without compromising the ability of future generations to meet their needs (WCED 1987).

In this descriptions, there is no direct or exclusive reference to ecological viability. Rather, the emphasis is on the phenomenon of 'development' or growth. WCED does refer to the notion of limitations on the environment's capacity to meet present and future needs, but it sees these limitations as imposed mainly by the state of technology and social organization: "In essence, SD is a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations (WCED, p.46). This basically reflects an economists' approach to the notion of SD: it is the level of human welfare that is to be sustained, or perpetuated, through economic, institutional and technical change. "Sustainable development is non-declining welfare per capita..." (Pearce 1994).

Others qualify this by focusing on the 'physical' basis (i.e. the natural resources) of the economy. They often infer, that SD implies such a distribution

over time of aggregate resource stocks, that at no future point of time the potential of this stock to generate welfare, is below the current potential (e.g. Pearce 1986, Jacobs 1985, Repetto 1986). This implies the maintenance or even improvement of the main life support systems, essential ecological processes, and species diversity (IUCN 1980). This approach could be labelled the environmental approach, in contrast with a purely economic one. Here, economic development is defined as sustainable if:

(i) the environmental impacts in consequence of it do not impair the functioning of resource regeneration systems, waste absorption systems and the systems supporting flows of other environmental services and goods, and

(ii) when use of nonrenewable resources is compensated for by at least equivalent increases in supplies of renewable or reproducible substitutes (Opschoor 1992). Sustainability thus defined means that, ceteris paribus, the interactions between the economy and the ecology can be continued qualitatively and quantitatively at least the current levels (see Par. II.5 for qualifications); "it leaves the world as rich in resources and opportunities as it inherited" (Beguin-Austin, 1993:8).

II.2 Environment as Infrastructure for Development

Underlying the concern over ecological sustainability, is the notion that the environment provides an infrastructure without which the economy could not survive: ultimately, all material (including energy) transformed by productive activities into goods and services providing satisfaction, originate in nature. These flows will have to continue, and that implies that a great number of ecological systems and processes ("life support systems") are to remain in operation and even be reinforced: biogeochemical cycles will have to continue circulating compounds through the biosphere; ecosystems are to remain capable of assimilating and breaking down pollution; resources such as fish populations, forests, soils, are to remain capable of renewing themselves or to be renewed, etc.; the biosphere is to remain a habitat to *Homo sapiens* providing shelter (eg, protection against UV radiation) and amenities (eg, landscapes, scenery and biotic diversity as such) that directly. These are examples of the 'infrastructural functions' of the environment. Below, we shall focus on the infrastructural and instrumental functions of nature, and assume that its integrity (in terms of species diversity and the associated diversity and size of biotopes) is maintained at accepted levels (see III.3).

Given those levels, given the patterns and levels of the economic activities and their environmental impacts, and given the prevailing state of science and technology, the environment provides a range of resources and services (all to be referred to below as: resources), that can be imagined as a multidimensional 'environmental utilization space' or EUS (Siebert 1982; Opschoor 1987, 1992). The EUS is defined as the locus of points (representing rates of exploitation of renewable resources and rates of pressure on assimilation systems) that lead to non-negative changes over time of environmental quality and resource stocks. If economic activities generate claims on the environment that exceed the limits of the environmental space, then the biosphere's (future) capacity to satisfy human needs is affected adversely. Welfare economists might refer to the EUS as an "environmental utilization possibilities frontier". The environmental utilization space is in danger of shrinking (especially on a per capita basis), unless technological innovati-

on and (inter)national resource utilization management and related policies can be dramatically speeded up. Daly (1972) has referred to the limited capacity of the biosphere to set limits to the 'scale' of the economy; as a metaphor for this capacity he used the concept of a 'Plimsoll line'. This is exactly what the notion of EUS captures and represents: the EUS is the multidimensional set of relevant Plimsoll lines for ecologically sustainable environmental pressures by the economy.

The notion of an EUS suggests the need to develop in operational terms a corresponding set of (physical) sustainability indicators, and it entails the need to search for strategies and instruments that curb the levels of economic activities to remain within the EUS.

II.3 How much Environmental Infrastructure to Maintain?

The ecological aspect of sustainable development appears to be a fairly objective and tangible one, but this is not quite so. In order to render it truly operational, several a priori choices have to be made. These choices have to do, inter alia, with (i) whether one allows for more or less substitutability of natural and anthropogenic resources, (ii) how much consideration one allows for intrinsic values of other species, and (iii) what risks one is prepared to take when it comes to environmental impacts. These issues will be discussed below.

Weak or strong Sustainability

Maler (1990) refers to development as sustainable, "...if the total stock of resources -human capital, physical reproducible capital, environmental resources, exhaustible resources- does not decrease over time" (cf. Solow 1986). Pearce and Turner (1990) take SD to mean: "...maximising the net benefits of economic development, subject to maintaining the services and the quality of natural resources over time" (see also my own definition, in II.1). Maler's definition allows for substitution between the various kinds of capital (produced, human, natural capital) and accepts a dwindling of natural resources as long as it is compensated by extensions of physical and/or human capital that is not accepted if one follows the definition given here or that of Pearce and Turner. The Maler/Solow-position has been referred to as "weak sustainability"; the other position (adopted here) has been labelled "strong sustainability". These positions reflect a difference in assumptions over the degree of substitutability of the different factors of production on the economic process at large. Economists would recognise this as a difference in the assumed form of the production function: one with variable technical coefficients and hence substitution (weak sustainability) as against one with fixed coefficients and hence no substitution between natural and man-made factors of production (strong sustainability). Note that strong sustainability according to the definitions by Opschoor and Pearce and Turner does imply the possibility of substitution and compensation within the category of natural capital. That is, within the portfolio of natural capital, several assets may substitute for one another and the loss of specific assets at specific locations may in principle also be compensated by reconstructing them (or developing substitutes) elsewhere. Of course one could envisage situations where natural assets can indeed be replaced by produced ones without loss in sustainability for the system as a whole. The World Bank basically adopts a weak approach bot allows for constraints in the cases of irreversible

environmental changes and loss of biodiversity.

Here, again, a relatively strong position is assumed, as environmental life support systems and produced capital are to be regarded as complementary rather than substitutable and socioeconomic development depends on both (Opschoor and Reijnders 1991; Costanza 1992; Folke 1992); this position gains credibility when one considers how little is actually known about the factual elasticities of substitution and when one observes ecologists' concerns (see also Pearce 1994).

An Ecocentric or Anthropocentric Approach

Another choice has to do with the domain of the notion of sustainability: is it to encapsulate only human interests, or are we to concern ourselves also with the prospects of species other than *homo sapiens* and maybe even of ecosystems? In the first case, we use a narrow, human interest oriented definition of sustainability; in the latter case sustainability is regarded from some *ecocentric* point of view, i.e. one takes a wide view. In the narrow view, the value of biodiversity is derived only form the significance of it in economic terms. That is, species and ecosystems diversity may have a value based on their various ecological functions in terms of providing a carrying capacity for humans or for human activity, they may have a value as they directly or potentially enter into production functions or utility functions, etc. Others acknowledge that species may have existence rights independent of their instrumental values. It is assumed below, that any concerns over other species' "stakes" will be taken into account by constraining our collective use of natural resources by setting aside (e.g. through zoning) parts of them in the 'interest' of these species and ecosystems.

A Risk Taking or Precautionary Approach

There also is the problem that it is often unknown what is (un)sustainable. There is true uncertainty about many aspects of the significance of ecological processes; e.g. it is unknown how earth systems (such as climate) will behave when human interference with these systems brings them in states beyond ranges that these systems have ever been in before. Also there is the stochastic nature of many of the processes that actually determine the biospheric carrying capacity for human pressure. Views on the magnitude of this carrying capacity thus also depend on one's attitudes toward risks and uncertainties. A fair and prudent assessment of the extent of the environmental utilization space may leave much less room for economic development than an anthropocentric and risk accepting one. The Rio Declaration (UN 1992) advocated a precautionary approach. In practical terms this means that, where standards must be set as constraints on economic development, a risk aversive position is adopted and the so-called "safe minimum standards approach" will be favoured.

II.4 Do Sustainable Development Paths Exist?

Sustainability of development entails that three conditions are met simultaneously: (i) environmental or ecological viability (i.e. the observance of the need to maintain the environmental infrastructure); (ii) economic viability (i.e. constant or rising per capita welfare levels); (iii) social viability (reduction of inequality, enhan-

cement of human capital and social investment). Together, these three constraints may demarcate an empty set in terms of strategies or pathways towards such a sustainable economy. In other words, there may be trade offs to be made between ecological sustainability and its implications in terms of current consumption levels. It may even be that the only conceivable pathways towards sustainability imply the need to cut down drastically the consumption and/or production in certain regions, or, alternatively, to reduce population growth. Such strategies might meet with strong ethical or political objections. In order to ensure that ways to achieve sustainability exist, I propose that:

- sustainability does not have to be reached overnight, or: the process of change as proposed by WCED may take some decades to be realised and different regions may have differentiated responsibilities in terms of the time horizons within which to achieve regional sustainability;
- sustainability implies a preferential treatment of the poor in terms of their enhanced access to the environmental utilisation space; in other words, the North and the elites in the South may have to move in order to make space for the underprivileged.

II.5 Market Mechanisms and Sustainability

Valuation of Environmental Capital Stocks

The environmental infrastructure discussed above can be regarded as "environmental capital", the revenue or interest of which essentially is the EUS. Environmental capital has been defined as the aggregate net present value of the various resources in an economy's resource base. Let us assume that 'nature' is made up of a set of separable entities e(i), available at level E(i), and that for each unit of e(i) a net present value of v(i) exists. Environmental capital C would then be the summed product of v(i) and E(i). Above, we have questioned the assumptions of separability and unrelatedness of the various e(i), but even apart from that a large number of problems with respect to resource base valuation remain, especially when it comes to using such valuations as guidelines for the rates of exploitation/exhaustion of these resources.

The first problem is, whose valuations or preferences are to determine the v(i)'s and with what intensities. Are individual valuations weighed according to income or purchasing power, or is a more egalitarian determination process envisaged? Do we look at the present generation's assessments only or should future generations at least codetermine the v(i)'s? If future generations' preferences are to count, then what time horizon is appropriate, and how much weight should be given to each generation? Any set of answers on these questions deviating from: "present generation's preferences weighed according to purchasing power and the going rate of time preference", leads to the need to setting some kind of social or 'solidarity' value s(i), with typically $s(i) > v(i)$. The alternative to determining such s(i)'s would be to have society decide over the time distribution of minimum levels of E(it)'s, over some relevant planning period.

The second problem relates to the base of the individual v(i)'s. Neoclassical environmental economics has yielded a variety of aspects that individuals have to take into account. The value of an e(i) to an individual is the sum of his/her *user*

benefits and *nonuser* benefits. The user benefits are composed of the net market value of the e(i), the user's welfare surplus on it, and the option value that the individual places on retaining the option of use of the e(i) in future. The nonuser benefits reflect the individual's preference for leaving a certain e(i) available to future generations' use ('bequest value), and his estimate of the 'existence value' or intrinsic value of keeping e(i) on the planet, even if it will have no use value ever. Purely functionalist and egotistic individuals would only count the user benefits. The bequest values reflect the individuals' positions vis-a-vis the preferred level of intergenerational solidarity; the existence values reflect individuals' positions vis-a-vis nature conservation quite apart from any use related benefit. It will be obvious that nonuser values are hard to determine empirically. However, there are more fundamental problems associated with them: (i) society as a whole may take a different view as to the collective bequest value of an e(i) on the basis of a different solidarity weighing (as we saw); and (ii) society may have a different view of existence values or even user values of certain e(i)'s on 'merit grounds' (Opschoor 1974, James et al 1978, Siebert 1987). The latter means that individuals simply are not accepted as the sole and best judges of the societal value of the elements of the environmental infrastructure; societies taking that position will either have to determine 'merit values' m(i) (with, typically, $m(i) > v(i)$), or decide on the significance of these merit considerations for the time distribution of the minimal levels of E(it).

Finally, working with v(i)'s, s(i)'s or m(i)'s implies the assumption that individuals or society as a whole are capable of projecting all different types or aspects of value on a single plane, where these aspects can be aggregated into one single value parameter ('welfare', or 'utility', typically expressed in monetary terms). The approach suggested above, i.e. that of safe standards to ensure the survival of certain minima in terms of life support systems or ecological infrastructure (and habitat for other species) implies that decisions vis-a-vis the rate of using or running down a single resource stock or even environmental capital as a whole, cannot be determined on efficiency grounds and values alone; one-dimensional comparisons of costs and benefits may then be unacceptable as the sole decision aids to be used and tradeoff analysis, multicriteria analysis and other non-economic techniques may be more appropriate.

The various paradigms take different stances on these questions.

One important mechanism for disclosing values is the market mechanism. Given the almost exclusive role attached to that mechanism in this respect, it is important to explore to what degree it is capable of generating correct signals in terms of values. Of course this has to do with the discussion on v(i), s(i) or m(i) above.

INSTITUTIONAL CAUSES OF UNSUSTAINABILITY

Economic activities are the most manifest sources of environmental stress: they are based on extracted raw materials and energy, they pollute, and they imply spatial claims damaging the integrity of natural environments. This stress is a problem only in so far as environmental buffering capacities are exceeded and this excess is not compensated by remedial activities. Economic activities are the substrates and manifestations of larger societal processes, tendencies, urges and drives. Amongst these there are three that have, since the early '70s, been singled out as the alleged main causes of environmental destruction: *population growth* ,

economic growth , inappropriate technological change). But we have to dig deeper yet. Behind the forces mentioned, there are some more structural causal mechanisms at work, such as: predominant cultural *a priori's* and world views (including views of humankind-nature relationships; see e.g. O'Riordan 1981, Opschoor 1989), poverty (see notably WCED 1987) and institutional failure to accommodate to the emerging environmental realities (see e.g. O'Riordan 1981; Opschoor 1990). This paragraph looks at this latter cause of unsustainability in particular. By institutions I mean: all 'arrangements' (both formal and informal ones) and social conventions and patterns of conduct, including economic mechanisms such as the market and market regulating structures. Unsustainability when looked at from an institutional angle, can be attributed to several kinds of failures in the decision making processes that direct the course of economic developments. We refer to them by using the terms for failures in OECD discussions (e.g. OECD 1990): *government failures* and *market failures*.

Government Failures

Government failures can be divided into *policy failures* and *administrative failures*[1]. One speaks of policy failures when prevalent policies are based on past decisions in which ecological or environmental considerations were given insufficient weight. The latter very often is the case with sectoral policies where sectoral interests and powers have predominated over, or excluded ecological considerations, or with policies dating back to periods of time when environmental problems were not yet perceived fully. Examples are: policies in the areas of agriculture, energy, transportation. One may also speak of policy failure when policy is directed at enhancing economic growth *per se*, that is, disregarding social and ecological repercussions of the growth paths that these policies imply. Thirdly, one may speak of policy failures when national or international policy fails in developing adequate institutional checks on market failures (see below).

Very often past sectoral policies (e.g. in the field of energy, agriculture and transportation) in many countries and regions at least in the North, have been decided upon primarily with the sectoral interests in mind, at best with consideration for trade offs vis-a-vis other established sectors. Environmental concerns have not been appropriately internalised. Apart from this, not only private sector but also public sector decision makers have limited time horizons and/or discount future consequences of present decisions. Thus, policy formation may suffer from biases towards stronger (in terms of economic and political power or significance) sectors and against interests that cannot manifest themselves on markets and in

---

[1]The notion of administrative failures refers to a range of problems within the organization of government at the various levels, leading to inadequate policy formulation and/or inadequate policy implementation. Examples include: rigidities due to entrenched traditional divisions of labour within administrative organizations (very often along sectoral lines), high time preference even within governmental organizations, insufficient integration between agencies and departments, instruments or powers insufficient to achieve policy objectives, lack of instruments or powers to ensure policy implementation within the economic processes.

the political arena, such as future generations' interests. Sectoral policy failure (as this may be called) may result in the subsidisation of sectoral activities so that prices no longer reflect even private costs. In resource related sectors such as agriculture, water, timber and energy, this leads to artificially low resource prices. On top of this, (environmental) externalities are often ignored so that private costs in themselves were distorted reflections of social costs (see the next paragraph). In such cases, users the products of these sectors are paying less than the social costs their use gives rise to; they thus are induced to consume more than would be the case were the price corrected for social costs. Prices then give the wrong signals and the sector may expand to levels beyond what is socially desirable.

Given the fairly rigid extent of the Environmental Utilization Space (at least: in the short run) we first look into some determinants of the processes leading to economic growth as an inherent and unchecked force potentially taking society beyond the boundaries of that space. Economic growth in itself may be beneficial for many obvious reasons. One problematic feature of it, however, is that it tends to take economies beyond what is ecologically sustainable in terms of the implied claims on natural resources and/or in terms of environmental pressures exerted through pollution, waste generation and ecosystems modification. However, economic growth consistent with the maintenance of environmental quality may be possible over some finite time horizon (Perrings 1990) and in many regions of the world. Ultimately, and depending on the rate of aggressiveness of economic growth, it is likely to become unsustainable and uncertain in its effects (Perrings 1990b). As the manifestations of unsustainable use of the environment tend to be removed in time from the moment of their being generated, this growth tendency may remain unchecked or uncorrected for too long, leading to irreversible changes or changes that will be very costly to redress in future.One could refer to this as failure to manage the economic process.

Other sources of government policy failure may be biases brought into the system of prices in consequence of taxation policies, notably the common practice of taxing incomes or expenditures in such a way that the relative scarcities between labour and other factors of production (especially environmental quality and natural resources) are no longer reflected.

Market Failure

Market failures have traditionally been defined as inefficiencies and injustices inherent in market forces operating under certain conditions such as imperfect competition, imbalances in the distributions of power and property rights, etc. Amongst the injustices referred to, is that of a skewed distribution of incomes, unfair wages, etc. Notorious classes of inefficiencies have to do with external effects and imperfect information. Under externalities we have learned since the late '60s to include environmental degradation. Market failures are defects in the market mechanism that lead the economic process away of what would be societally desirable.It has long been established (Kapp 1950) that the economic process as directed by decentralized decision making based on market signals and competitive behaviour, leads to 'cost shifting' or 'displacement of costs' (Pearce and Turner 1990; Opschoor 1989). That is: part of the adverse consequences of one actor's decision are passed on to others to bear. Economic activities lead to effects that are external to those who decide over these activities in the first place. In other

words, economic activities lead to *social costs* (including the costs of environmental degradation) that are not fully translated into *private costs* , or internalized into the private decision making mechanism. This practice of cost shifting is facilitated by what could be labelled as: the 'distance factor'. The consequences or effects of environmental degradation in relation to economic activities manifest themselves at often large distances from the source or agent causing them. This may be a distance both in terms of *space* and *time* (e.g., DDT in polar ice caps, chemical time bombs and climate change). Effects of environmental degradation are thereby shifted on to other people, to future people and even to other species. There is a third type of distance involved, namely that between the level of one's individual influence and the level at which a problem must be addressed for its solution. One could refer to this as: *distance in scale*. Single actors in a multi-actor context may face situations where their privately optimal behaviour may lead to socially or collectively undesirable overall outcomes (the 'prisoners' dilemma' in the case of very few actors, or the 'tragedy of the commons' in the case of many actors). Examples are: countries sharing a common resource, individual fishermen exploiting a shared fish population, etc. In many cases, the absence of control and intervention by national or international authorities, leads to an irrational exploitation of a shared or common property resource, to ongoing pollution, etc. Distance between cause and effect - that is what combines these various situations. And if such distances facilitate cost shifting, then what is optimal from an individual perspective may not at all be optimal from a social or collective perspective. Where such distance factors prevails and the party on which the burden is shifted cannot counteract this distance by pressing his interest, government intervention is needed. This is quite obviously the case with a range of environmental problems. Reasons why these "external" interests are not adequately internalised, include:
a) absence of legally based 'property and access rights' protecting the damaged party, or of liability/accountability regulations enforceable upon the causal agent;
b) absence of means to exert 'countervailing power' (Galbraith) through the political system (lack of *voting power* as in cases of transboundary cost shifting, or intertemporal cost shifting, or cost shifting onto other species), or through the market place (i.e. lack of *purchasing power*).

The various paradigms take different stances on how to deal with these forms of institutional failure: basically, the neoclassical school (including its environmental branch) will argue in favour of an efficiency-oriented, market-conform approach, whereas its institutional/ecological counterpart will have doubts about the generality of that solution and are for regulation OF the market as well as for regulation VIA the market.

III Economics and SD: some relevant paradigms

III.1 Welfare

Economics -whatever its specific inclination or paradigm- basically is about welfare: how it is generated and how it is distributed. Human welfare is defined as the amount of satisfaction people derive from their expected levels of 'consumption' over time. It depends on the availability over time of an adequate supply of elements necessary to generate welfare: natural capital, produced capital and human capital. Other (pre)conditions for welfare generation include: a productive

distribution of knowledge and know how, and an institutional infrastructure capable of governing interactions and decisions related to welfare and the use of its various determinants. Welfare thus depends on environmental capital as well as on physical and human capital (in a way that is structured by the institutional context). These various forms of capital are more or less hierarchically related (e.g.maintenance and replacement of physical capital heavily depends on the size and composition of environmental capital; the extension of human capital is bounded by the availability of physical and natural capital; etc). To a certain degree, they can also be seen as substitutes for one another in terms of sources of flows of factors of production into a welfare generating process. Traditional economics (mainstream or 'neoclassical' economics) studies the impact of physical (manmade) capital and (more recently) human capital on welfare. Neoclassical *environmental* economics reintroduced environmental capital as a third factor in the analysis, though at a usually very aggregated level (the environment as a single variable). A growing number of economists (e.g. Kapp, Norgaard, Daly) looks at society-environment interactions from an integrated and broader systems orientation.

A second relationship between the biosphere and welfare is, that the state of the biosphere or of components of it, may in itself be a factor contributing to human welfare. Amenity values, naturalness of environments, ecosystems' integrity and biological diversity in general, may be perceived by people as factors influencing the way they feel about their living conditions. Hence, environmental quality may be a direct (through its immediate effect on the human state of mind) and an indirect (as an essential factor of production of welfare generating goods and services) contributor to welfare. Traditional economics would take this for granted as its normally takes preferences for granted, and calculate from this a 'demand' for environmental quality in terms of direct use and non-use values (see Pearce and Turner 1990). More 'ecologically' oriented economists put (economic) welfare in a hierarchy of values to consider, including continuity of life and well-being, and in such a view there may be non-economic values to be ascribed to especially the infrastructural aspects of the environment, which take precedence over whatever economic preferences may indicate (see below).

Economic welfare thus may not be a sole criterion for deciding over environmentally relevant options; nevertheless, it would most certainly be 'uneconomic' in principle to ignore the direct and indirect impacts environmental quality has on economic welfare.

III.2 Paradigms

In the economics literature on environmental problems one may discern a bundle of more or less fundamentally different approaches. In this paragraph we shall present 'snapshots' of several of them (not all), in black and white. This distorts the representation and I apologise for that to those who feel that I have twisted their ways of dealing with environmental issues.

A. Neoclassical Economics basically operates from a stylised 'model' of society and humankind that may be captured by adjectives such as: mechanistic/rationalistic, efficiency-oriented (i.e. allocation-focused, not: scale-focused). It assumes given preferences (often including preferences for future generations in an

'overlapping generations' function), and typically approaches environmental degradation as externalities stemming from decentralised decisions in a market (or market analogue) context. People and institutions behave rationally, they base their decisions on optimisation (in cost-benefit terms) given their preferences and limitations to their means as provided by their economic and environmental contexts. Both in production and consumption activities, the typical approach is to consider that alternatives ways and means exist to arrive at a given end or to perform a certain function: substitution. Technological progress is assumed to affect these (production) functions and constraints; mostly this is regarded as an exogenous phenomenon.

B. Neo-Austrian economics is a tradition that is much more explicit about the role of time in economic phenomena. Hence, intertemporal and dynamic aspects are normally treated much more carefully, but often at the expense of generality in outcomes predictions (compared with neoclassical economics). Also within this line of thinking technological innovation has been treated more realistically (e.g. by Neo-Schumpeterians) but with the same impact on predictive capacity. It is also typical to take intersectoral linkages into account much more, e.g. by using input-output (fixed technical coefficients) models where their neoclassical counterparts would insist on modelling on the basis of substitutability.

C. Modern evolutionary economics might perhaps be regarded as a hybrid of A and B. Formally, it uses models derived from chaos theory and behaviour under uncertainty. It is interested in forms of self-organisation emerging in disequilibrium situations (where especially neoclassical economists tend to rely on more 'conservative' equilibrium-seeking mechanisms. The influence of surprises is looked at seriously, and behaviour is seen as driven by local forces (both in space and in time): concepts such as 'selection environment' and 'learning' (eg, by trial and error) play a major role as determinants not only of innovation but also of behaviour.

D. Institutional economics (and/or traditional evolutionary economics) sees the economic process as embedded in, and interacting with, a wider socio-political setting that cannot be ignored analytically as is typically done by neoclassicals. They come closest to the traditional 'political economy'-approach of classical economics, but have more interest in micro and meso processes. Like with the Neo-Austrians, the widening of the conceptual horizon has implied that less general results come out of the analyses. One typically employs non-mechanistic approaches and allows for 'circular causation' between social and economic processes. Another feature is the much less reductionist approach to valuation: one operates on the basis of assumed 'value hierarchies'.

E. Modern Institutional Economics is a hybrid of A and D. It studies changes in institutions by using methods derived from neoclassical (micro-)economics. There is an interest in property rights (and access rights), behaviour is often studied in terms of rent-seeking, institutional differentiation and the implications thereof are approached by principal-agent models based on asymmetry of information/power assumptions, transaction costs are regarded as important mechanisms

in understanding frictions or divergencies between prima facie rational and factual behaviour, etc.

F. Ecological economics is a relatively new school, drawing methodologically on D, which is injected with concepts and theories from (bio)physics and ecology; it also borrows from C. The main point however is its openness to natural science and to realism and profoundness in the analysis (and modelling) of environmental phenomena. This means, that like other paradigms such as (B), C and D, it uses simulation models much more frequently than optimisation models. Also in its approach to values it draws on D, which means that it accepts value hierarchies and institutionalised bounds to the domain of 'economic'rationality and the scale of economic activity. In its normative branches it starts from sustainability-related ethics and searches for co-evolutionary 'ecodevelopment'.

As A and B differ basically only in their treatment of time and their time horizon, we shall discuss only one of the two, i.e. the (dominant) neoclassical paradigm; the latter school will be traced to its offspring: neoclassical "environmental" economics. Of the alternative, 'politically' oriented schools I have selected the institutional/evolutionary paradigm (D); this in its environment-oriented branches, tends to develop by co-opting biophysical and ecological approaches from the natural sciences and to form an amalgam labelled "ecological" economics (F). Hence I shall treat these two together, as an alternative to neoclassical (environmental) economics.

Re A: NEOCLASSICAL ENVIRONMENTAL ECONOMICS:

Neoclassical economics analyses what is regards as the economic aspect of human behaviour from a perspective that can be characterized by 4 premises:

(i) the 'fixed context' premise: a large range of parameters is assumed to be fixed or 'given' including: (a) institutional arrangements (i.e. the economic system itself), (b) preferences and wants, (c) the state of technology (and its rate of change), (d) the state of the natural environment. Basically, this means that numerous relevant variables are left out of the analysis. Neoclassical economics is more interested in exchange relationships between different actors in situations of different factor endowments and is prepared to ignore in its main stream the realities a through d above.

(ii) the 'maximization' premise on behaviour: this is the assumption that individuals and groups will try to maximize their objective function (i.e. utility or welfare for individuals, and profit for enterprises). Neoclassical economics assumes: a) that individuals independently form preferences reflecting individual values; b) that they behave and chose rationally, by taking their utility into account predominantly if not only, and c) that individual values are to count exclusively in all matters. Implicitly this often entails that individuals are assumed to be well informed about the alternatives in front of them.

(iii) the 'weighing' premise on evaluation: this implies that all relevant changes as a consequence of economic choices, can be expressed in a welfare related, one

dimensional entity, so that these costs and benefits of all alternatives can be reduced to neat (ordinal) balance figures which can be ranked. Hence, all different types of value are to be projected into one single plane where they can be aggregated into one dimensional entities such as 'utility', 'net benefit' or 'welfare'.

(iv) the 'market optimality' premise: within certain boundary conditions, coordination of economic decisions and hence the development of the economic process, are assumed to best (in the sense of 'optimal') be institutionalized if run via the market mechanism.

Thus, individuals separate out utility-related aspects of their behavioural options, they rationally calculate their costs and benefits and they chose accordingly; their actions are 'coordinated' by a market mechanism that -indeed mechanically- equates or equilibrates the consequences of these actions and decisions in terms of the exchanges they imply between the various members of society. The concern is with the efficiency of the social processes (i.e. markets): the more efficient, the greater the general welfare (apart from distributional issues).

Mainstream economics has recognised that regulating market forces may be necessary when all conditions for efficiency are not met. Market failures may result from externalities and from common (open access) resources; both are typical of environmental and resource issues. The early answer to (environmental) externalities was formulated by Pigou (1920): taxes or charges to equate marginal social costs and benefits. According to Coase, however, taxes are not necessary for efficiency. Coase proposed an approach centred around a negotiation or bargaining approach: if bargaining ('transaction') costs are low, parties will achieve an efficient solution. A third solution advanced by neoclassical economics was to allocate access and/or property rights to environmental quality and to resources, and to allow trading between those who wish to use or put pressure on the environmental resources and those who hold rights to those resources. Thus, environmental problems are basically seen as the results of market failure that -in cases of high transaction costs precluding bargaining solutions- necessitate interventions to correct for these failures: direct price interventions, or the creation of new markets through the rearranging of access/property rights.

On efficiency grounds alone, it is already important that the socially optimal level of environmental degradation be established; this would require that (at the margin) efforts to prevent, mitigate or compensate environmental degradation equate the damage that would occur in the absence of such efforts. Hence the issue of valuation; premises ii and iii show the direction neoclassical environmental economics thinks in. Basically, damage is measured by the value lost by an environmental change: the sum of use values (to individuals) and nonuse values (to those alive today) at issue.

In terms of the four premises discussed above, environmental economics has managed to partially relax the fixed context premise: interrelationships between economic activity, environmental quality and welfare are acknowledged and analyzed, but very much from a traditional point of view and as much as possible (or even more so) with resort to the conventional concepts. In terms of the market optimality premise neoclassical environmental economics has contributed largely by suggesting ways of remedying some sources of market failure, thereby enhancing

the potential efficiency of markets.

Re D/F: Institutional/Ecological Environmental Economics

In terms of the premises described above, institutional/ecological economics can be characterised as follows:

(i) 'Circular interdependence' replacing 'fixed context'

Most neoclassical models fail as adequate descriptions of the institutional and biophysical realities which do form the initial settings within which societies and hence economies develop. They have even been more insensitive to the interactions between the process of development and changes in these institutional and biophysical parameters. Often an elaborate analysis of the system as a whole is needed, if all relevant feedbacks are to be understood and dealt with. To do justice to these realities, the other subsystems must be described in terms of a reasonable model of the processes within them. Typical in the institutional approach is the incorporation of social and political variables, often in an historically based analysis.

Typical of the ecological extension of this paradigm is that ecosystems and the relevant processes therein are modeled and analyzed in detail, and in explicit relation to economic activities and processes. Institutional and evolutionary economics basically reject a reductionist and mechanistic view and replace that by a more integrated (some even go as far as to advocate a 'holistic'), and developmental or 'evolutionary' (sometimes labelled: 'organic') approach. The 'fixed context' premise is replaced by one of 'circular interdependence'. Circular interdependence is incorporated by working from the notion of chains of triggering factors, causes, effects, responses, etc. that link the economy to environmental processes and structures.

(ii) Behavioral pluriformity

This implies that other, less rigid and strenuous approaches such as 'satisfying' assumptions may replace the optimisation/rationality assumption of neoclassical economics. Behaviour may be conventional (where of course trial and error or learning may in the past have given rise to conventions that were and perhaps are optimal), the rationality of decision making may have been bounded by limitations on information, etc.

(iii) Co-evolutionary Instrument Values

Society as a whole is taken to have values that may deviate from individual values e.g. on the basis of society's much longer life expectancy or on that of a paternalistic concern over individuals' wellbeing beyond their own concerns. Valuation approaches from a neoclassical, individual based perspective, may hold in a certain domain, but cannot always generalized to statements on public goods and merit goods. Institutionalists postulate the existence of a hierarchical value system. Beyond wants and welfare, they perceive 'values' as operators on human and societal behaviour. In assessing economic performances, institutionalists may use as a criterion: the institutions' instrumental significance for realizing these deeper or more ultimate values such as "continuity of human life and community" (Swaney 1987); notions such as 'sustainability' or 'environmental compatibility' can easily be

derived from these. In fact, a social value hierarchy could be postulated in which societies, with the support of the individuals in their capacities as 'citizens' opt for social states that cannot be deduced as optimal from their market behaviour. Institutional or evolutionary economics thus typically employs an ethical approach biased towards values expressed in terms of 'rights' rather than 'utilitarian theories'. In terms of standard welfare theoretical analysis, this means that one postulates a third criterion, in addition to efficiency and equity, namely that of co-evolutionary sustainability.

(iv) Regulation and Markets

Kapp (1950 and 1974) has argued that the phenomenon of 'externalities' is endemic and pervasive within any society with decentralized decision making, including market economies. In such economies the 'shifting of costs' to others than those causing them, is an institutionalized form of behaviour to be expected by e.g. firms, as it is rewarded by competitive success. Kapp's theorem of 'cost shifting' was a fundamental critique of the 'externalities' analysis of the neoclassical. Markets are institutional arrangements associated with externalizing ('cost shifting') behaviour. Solutions to that are often to be found beyond market structures. "Market mechanism conformity' therefore cannot be a criterion for judging the adequacy of new environmental policy instruments. The market mechanism itself should be judged instrumentally, in terms of its consequences. Efficiency is not necessarily the result of market processes alone, and concern over sustainability may factually imply the need to resort to other mechanisms. Institutional economics looks at the institutions and instruments of environmental policy in a much broader context than does neoclassical economics. Not only is there an explicit interest in the evolution and operation of non-market instruments in addition to market instruments, but also there is scope for an assessment of instruments in much more than its efficiency aspects: Their emergence and evolution is studied in relation to aspects such as: conformity with policy trends, administrative traditions. etc. Also in terms of institutions, the scope is wider: property rights, cooperative rather than competitive organizational strategies, environmental impact assessment and evaluation, societal decision making on investments, projects and policies, etc.

III.3 An Assessment

From the above resumes of several paradigms within economics, one could derive the following picture (in primary colours only and maximising contrast!!):

neoclassical/environmental economics	institutional/ecological economics
reductionist	integrative
mechanistic	organic/evolutionary
allocation/efficiency-oriented	sustainability/scale oriented
equity as relevant side effect	inequity as driving force
valuation: v-oriented	sensitive to (s,m)-values

In terms of their ability and sufficiency in addressing crucial environmental questions the two paradigms clearly take different perspectives on the role of future generations and other stake holders, they differ in their openness to biophysical and ecological detail, socio-contextual variety (culture, demography, technology) and institutional change.

From the above, it may appear that environmental economics is less appealing when it comes to addressing environmental and development issues, as its effective domain is clearly narrower than that of the alternative. To be quite frank on this, however, the following observations must be made:

1) A reductionist approach with a narrower domain leads to sometimes deep and sharp analyses, where other approaches apparently remain shallower, less pronounced, casuistic. As the above makes clear, there is a price attached to the apparent transparency and lucidity of the former approach.

2) What has been discussed here as institutional/ecological economics is in fact a rather loose set of approaches paying homage in various degrees to the institutional and/or ecological aspects related to development, whereas neoclassical environmental economics appears to be a much more internally coherent approach, albeit abstract and top down.

3) We have compared here an established tradition (i.e. that of neoclassical environmental economics, going back to at least 1967) with an emerging one. Or, we have compared actual performance in one approach, with what basically are not much more than potentials or intentions in ecological economics.

4) In real world issues, sometimes one and sometimes the other of the two paradigms could provide an apparently appropriate tool kit (Klaassen and Opschoor 1991); one should not, I think, dogmatically set up one against the other

In terms of the arguments put forward at the practical level of what is to be sustained and how to achieve that, the neoclassical position explicitly expresses much faith in the mechanism of substitution between the various kinds of capital, and the market mechanism to realise efficiency. They express rather high hopes in technological progress which they think will outrun depletion and provide us with the means to cheaply remedy or prevent pollution; this innovation may even come automatic, with economic growth if economic agents act rationally and with good foresight. Meanwhile, they express their love for future generations and other species through their present assessments of existence values and preferences for future welfare in an overlapping generations function. Solow (1986) states that the present generation does not owe to posterity a certain share in the stock of environmental capital, but rather: "access to a certain standard of living or level of consumption", disregarding the form in which this access is handed over: mineral deposits, capital goods, knowledge. Such notions however, risk becoming uncovered cheques on future possibilities, and a laissez passer for over exploitation of natural resources: these views disregard the hierarchical structure within which these forms of capital are related. In fact we know very little about substitutability between natural capital and produced (physical or human) capital; a cautious approach may be appropriate here.

Again in an attempt to provide a maximum of contrast, I suggest that the institutional/ecological paradigm appears to put its faith very much in the power of societies (either through governments or on the basis of social movements) to

curb economic processes and even to constrain rent seeking and accumulative activities by economic agents. There also is faith in the possibilities of innovation, if triggered by other forces than short term profitability on the market. The hope appears to be related to the pace at which society will move in the direction of sustainability compared with the rate of environmental destruction. In terms of love I hesitate to characterise ecological economists other than their neoclassical counterparts, though perhaps the inclination to think on the basis of an ecocentrist approach is found more amongst the former.

IV Economic Paradigms and the Operationalisation of SD

Sustainability is a notion that is extremely difficult to operationalise; par. II.3 discussed some of the conceptual issues in regard of this. This is not really an argument against using the phrase, however, for at least three reasons: (i) economics has always used (and even based itself on) fuzzy concepts, e.g. 'welfare' 'utility', 'capital' - all basically unmeasurable and even undefined; (ii) the concept has served to reopen the debate on environment and development globally, and that is -literally- of vital importance; (iii) there is no alternative phrase for opening up economic analysis and decision making for ecological realities.

Sustainable development is an ambiguous phrase: it points at certain qualities of the development process (e.g. its ecological viability and social feasibility) and at the same time it is clear that we are searching for a process that will eventually put the economy on a sustainable track: development towards sustainability. In the paragraphs below I shall attempt to indicate what the different paradigms might have to suggest in relation to more specific recommendations on each of these two aspects: (a) what do they say about indicators for sustainability, and (b) what do they suggest in terms of instruments to eventually achieve sustainability.

IV.1 Indicators

- Environmental economics in first instance attempts to value environmental change. In terms of the nature of this valuation, it is clear that individual preferences of the present generation are taken as the reference: the v's of Par.II.5 above. These v's include use values, option values (for possible future use) and nonuse values such as 'existence values'; together they form the 'Total Economic Value'. Ultimately, these values could be made explicit by asking people their willingness to pay for certain changes in environmental quality. Contained within total economic value is the use value which may or may not correspond with the market value of environmental changes. The latter would be closest to conventional applied economics; total economic value, however, would be a more appropriate measure in principle, according to welfare economics.

Related to sustainable development and the infrastructure or capital approach to it, this means that as much as possible economic or monetary values are attached to changes in the levels of specific environmental stocks or assets. In a weak sustainability setting, the net total (present) value of the changes in environmental assets, if negative, should be compensated by the (positive) savings or investment rate in the economy for the total capital stock to at least remain

constant. More sophisticated analyses might allow for population growth in these indicators by expressing them on a per capita basis, where relevant. There is a debate as to whether in determining present values of flows of changes over time one should, in the case of environmental degradation use a discount rate different from the current social rate of discount; the dominant position now appears to be that this should not be done but, rather, that attempts be intensified to find better monetary values for these future changes and to constrain development paths from adversely and irreversibly affecting life support systems, environmental quality and biodiversity.

In terms of macro economic indicators the above reasoning leads to attempts to correct the System of National Accounts so as to reflect and incorporate the monetary de- or appreciations of environmental capital, and to eventually come up with environmentally corrected estimates of Gross Domestic Product. Such corrected GDP-measures are very easily taken to at least be adequate proxies for calculating whether development is sustainable in the sense of Pearce: non-declining welfare per capita with corrected GDP being substituted for welfare.

The main focus of neoclassical economics is on efficiency, or perhaps: on efficiency within boundaries set by weak sustainability. That orientation combined with the 'market (near-)optimality'-premise induces an interest in monitoring market failures, e.g. taxes and subsidies implicit in factual market prices that are influenced by sectoral policies (such as in the fields of energy, transportation and agriculture).

- Institutional/ecological economics would, to begin with, take a much wider approach to valuing environmental change. It would put economic preferences for the environment as expressed by e.g. market values or even 'willingness to pay' in the wider context of value hierarchies which may imply constraints on the scope of lower level values. Continued human life and community override economic values and this could be taken to imply that the environmental infrastructure should essentially be passed on in at least the state it is in presently. This means that in this perspective or paradigm more significance is attached to values to be ascribed to other stakeholders (e.g. future generations) than can be derived from revealed utility functions. There are certain (though perhaps not very precise) boundaries to the domain and scope of economic valuation on neoclassical grounds (e.g. Hoevenagel and Opschoor 1991), having to do with the degree to which people can be taken to be informed, the relevance of their current assessments of future states of the environment, the scale of the environmental change that needs valuing, the degree to which the current generation and the total set of stakeholders overlap.

In so far as macro economic approaches are concerned, the reservations about valuation expressed above and the general openness to the diverseness of ecological realities both lead to an interest in accounting environmental change (in terms of infrastructure, resources and flows of goods and services) in physical terms, so that the factual developments in the state of the environment is monitored directly, rather than subsumed in 'welfare' or 'total capital' indicators. Given the interest in a range of determinants of social and individual welfare, performance indicators for economic development would look far beyond economic welfare as measured in GDP, and include some aggregate environmental quality indices as

well as indices for social quality (cf. UNDP's "Human Development Index, UNDP 1991). In an ecological perspective, priority must be given to indicators that provide early warning to societies on the long term trends in their ecological infrastructures: indicators for ecosystems' 'health', resource regeneration and productivity, and indicators reflecting trends in relation to driving forces of unsustainability: population levels, environmental claims per capita, changes in environmental impacts of products and technologies, etc.

Given its openness to social and political aspects, in an institutional/ecologic approach indicators are advocated and developed to measure (changes in) rights of access to and/or property of environmental resources and environmental quality, as well as their distributions. This concern with equity holds for national as well as for international indicators; in both cases there are links with what has been called 'ecological security' and that is one aspect of sustainability.

IV.2 Policy Instruments and Evaluation

The main questions in relation to instruments are: which (combinations) of instruments provide effective and efficient signals so as to arrive in time at a maximum sustainable development path. These signals will have to induce a cleaner and leaner economy: less pollution and waste and lower levels of material and energetic inputs into production and consumption. Depending on one's position vis-a-vis substitutability, absolute limits to environmental pressure will be regarded as relevant: the issue of the 'scale' of economic activities in relation to the carrying capacity comes up, as well as that of the preservation of specific aspects of the environmental infrastructure or life support systems. Basically, the 'scale'-issue as raised by Daly is nothing but the inverse of the problem of environmental utilisation space: the scale of the economy should qualitatively and quantitatively be in line with the environmental utilisation space or carrying capacity.

- Market-oriented economists will tend to basically look at efficiency aspects of instruments, and favour charges and tradable rights as market-compatible approaches to reduce pollution, waste and/or inputs. They also have an interest in the property rights aspects behind market failure, albeit a fairly abstract interest, with a bias in favour of private property.

- Ecological economists tend to be concerned with issues of scale, impressed as they are by the uncertainties about substitutability of produced for natural resources, irreversibility of biodiversity loss, etc. Notwithstanding their acknowledgement of the efficiency aspects, they are more focused on effectiveness issues and this generates an interest in other instruments such as zoning, standards, quantitative or volume-oriented instruments capable of curbing certain economic activities, etc. Moreover, they appear to often have a more profound interest in specific institutional reforms in terms of access and/or property rights, both private and communal.

On tools for evaluation of projects, programmes and policies, the two approaches discerned here differ as well.

- Quite consistent with its internal structure, neoclassical environmental economics would recommend a cost-benefit framework, making use of a range of innovative (but not all embracing) valuation techniques as reviewed above; it would be recognised that sometimes constraints on the applicability of this framework might necessitate other techniques, e.g. multicriteria analysis (see e.g. James 1994).
- Ecological economists often are biased in one of two other directions: (i) using other units of measurement, e.g. energy-related measures as somehow reflecting embodied ecological costs, or (ii) applying multi-criteria evaluation tools (coupled with some weighting of the various dimensions) in order to do justice to the complexities inherent in those programmes etc.; wherever possible and admissible using aggregation devices in order to limit the number of dimensions with which alternatives are to be presented.

V Conclusions

This paper has attempted to relate a number of paradigms or perspectives in economics to the notion of 'sustainable development' (SD) and how this notion is (to be) operationalised. Economic development was defined as sustainable if: (i) the environmental impacts in consequence of it do not impair the functioning of resource regeneration systems, waste absorption systems and the systems supporting flows of other environmental services and goods, and (ii) when use of nonrenewable resources is compensated for by at least equivalent increases in supplies of renewable or reproducible substitutes. Sustainability thus defined means that, *ceteris paribus*, the interactions between the economy and the ecology can be continued qualitatively and quantitatively at least the current levels. The economy remains within its "environmental utilization possibilities frontier", or environmental utilization space. Even thus defined, the specific content of 'sustainable development' remains unclear. This is so not only because of uncertainties in the stochastic sense or as a result of lack of knowledge, but this is so also because several normative elements will enter into any discussion on sustainability (par. II.3).

The notion of an EUS suggests the need to develop in operational terms a corresponding set of (physical) sustainability indicators, and it entails the need to search for strategies and instruments that curb the levels of economic activities to remain within the EUS.

Sustainability, however defined and operationalised, may entail the need to drastically rethink about phenomena that have become 'normal' in the various cultures, such as ever expanding material consumption or economic growth in general, and population expansion. In view of equity aspects, sustainability implies a preferential treatment of the poor in terms of their enhanced access to the environmental utilisation space.

From the above it is clear that sustainability is a value-loaded concept. Values can be perceived differently in different paradigms, political and cultural settings. One important mechanism for disclosing values is the market mechanism. Given the almost exclusive role attached to that mechanism in this respect, it is important observe that it fails, almost by definition, in generating correct signals in terms of values at stake. The various economic paradigms discussed here take different stances on this.

Behind unsustainability there are some structural causal mechanisms at

work, including institutional failure: it can be attributed to several kinds of failures in the decision making processes, such as government failures and market failures (par. II.5). The various paradigms take different stances on how to deal with these forms of institutional failure as well.

At least six different approaches ('paradigms') to economic and environmental realities can be discerned and they have been outlined(par. III.2). From these, two have been selected for elaboration and to trace backgrounds to a range of differences in opinion on unsustainability and how to measure or address it: neoclassical environmental economics, and ecological economics as a multidisciplinary blend of institutional and evolutionary approaches. Par. II.3 summarises the contrasts between these two paradigms. They do differ in terms of: (i) points of departure (deductive and reductionist, versus inductive and integrated), (ii) methodologies (analytical approaches versus simulation, optimisation oriented versus 'satisfying', etc.); they also differ in terms of (iii) operational recommendations (eg, on indicators and instruments).

Does one have to make choices between these paradigms? There are several reasons to be careful in this respect.

To begin with, looking at these paradigms as phenomena that emerge and evolve in a process of development of thinking about problems, one can see that in the course of this development hybrids may be formed that actually mix qualities that hitherto appeared fundamentally different.

Second, paradigmatic dogmatism makes for simplistic and/or biased analysis. "If one only has a hammer, one looks at every problem as though it is a nail"; however, environmental issues and development issues are multifaceted, multilevel, multicausal phenomena that may need approaches from more than one perspective. "Different tool kits for different problems": the various paradigms may have comparative advantages in dealing with different practical problems or with issues at different levels or time scales. One ought to be pragmatic rather than dogmatic about this.

Finally, at the operational level the two approaches CAN be analyzed as leading to complementary recommendations, as was clear in Section 4. This is another reason for being pragmatic rather than dogmatic about environmental/ecological economics. On indicators and instruments it appears wise, from a sustainable development interest, to not restrict policy recommendations to the concerns, approaches and results of neoclassical environmental economics.

Literature:

Beguin-Austin, M.(ed). 1993: Sustainable Growth: A Contradiction in Terms? Ecumenical Institute, Chateau de Bossey June 14-19 1993, Switzerland.

Daly H.E. 1972: Steady State Economics. Freeman, San Francisco

Goodland R. and G.Ledec 1986: Neoclassical Economics and Principles of Sustainable Development. World Bank, Washington DC

IUCN 1980: World Conservation Strategy. IUCN, Geneva

Jacobs P. 1985: Achieving Sustainable Development. Landsc. Plann. 12 (l985):203-209

James D.E., H.M.A. Jansen and J.B. Opschoor 1978: Economie Approaches to Environmental Problems. Elsevier, Amsterdam/Brussel

Kapp K.W.1974: Environmental Policies and Development Planning in Contemporary China and Other Essays. Mouton, The Hague/Paris

Maler K.J. 1990. "Sustainable Development". NAVF: Sustainable Development: Science and Policy. Conference Reeport, Bergen 8-12 May 1990.

Norgaard R.B. 1984: Coevolutionary Development Potential. Land Econ. 60(2):160-172

Opschoor J.B. 1974: Economie Valuation of Environmental Pollution. Van Gorcum, Assen

Opschoor J.B. 1987: Sustainability and Change (Inaugural lecture, in Dutch). VU Boekhandel, Amsterdam

Opschoor J.B. 1992: Environment, Economy and Sustainable Development. Wolters-Noordhoff, Groningen, Neth.

Pearce D.W. 1994: Reflections on Sustainable Development. Paper for Eur. Ass. of Envir. & Res. Economists, Dublin, June 22-24 1994.

Pearce D.W and K. Turner, 1990. Economics of Natural Resources and the Environment. Harvester Wheatsheaf, London.

Repetto R. 1986: World enough and Time. Yale Univ. Press, New Haven/London

Siebert H. 1982: Nature as a Ufe Support System: Renewable Resources and Environmental Disruption. Joum of Ecos. Vol. 42 no 2:133-142

Siebert H. 1987: Environmental Economics. Springer, Beriin.

Solow R.M. 1986: On the Intergenerational Allocation of Natural Resources. JEnv Ecs Man.4:1-24

UNCED 1992: Agenda 21 and Declaration of Rio de Janeiro. UN, New York

UNCED 1987: Our Common Future. Oxford Unh/ersity Press, Oxford/New York