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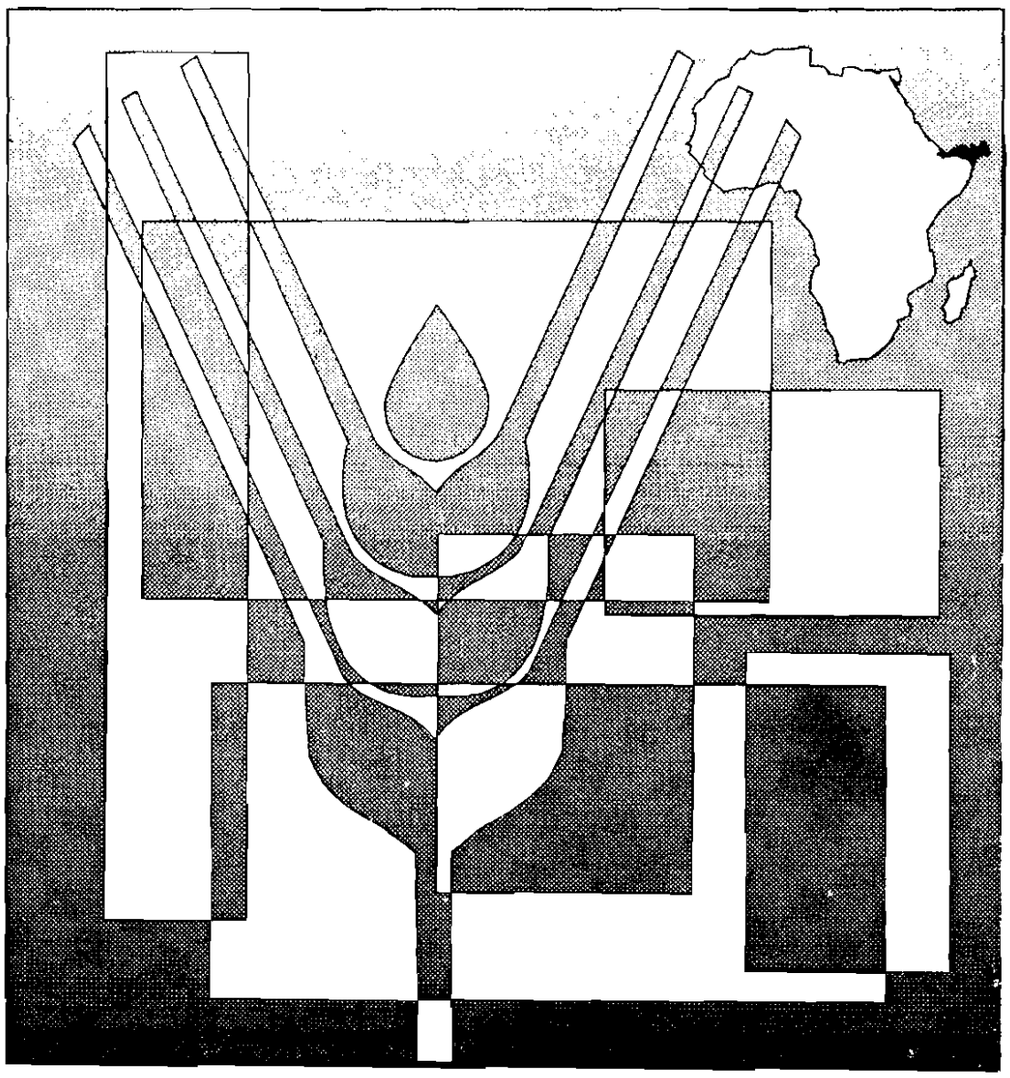
ECONOMIC GROWTH, SUSTAINABILITY AND AGRICULTURAL DEVELOPMENT



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ECONOMIC GROWTH, SUSTAINABILITY AND AGRICULTURAL DEVELOPMENT

by

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ECONOMIC GROWTH, SUSTAINABILITY AND AGRICULTURAL DEVELOPMENT

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Humankind has historically sought to modify and control its habitat, giving rise to increasingly "artificial" environments. While generally promoting the quality of life, such changes generate unanticipated, often detrimental, environmental consequences. In recent years, growing concern over the environmentally deleterious effects of current development processes throughout the Africa Region has raised the question of sustainability of such development process, especially in the agricultural sector. Mankind's relationship with the natural environment has traditionally been adversarial in character, emphasizing exploitation, whereas its relationship with the built environment (consisting of the infrastructure created to support human activity) has emphasized enhanced compatibility and improvement.

It may be the ultimate irony that in our efforts to make the earth yield more for ourselves, we are diminishing its ability to sustain life of all kinds, humans included. Signs of environmental constraints are now pervasive. Cropland is scarcely expanding any more, and a good portion of existing agricultural land is losing fertility. Grasslands have been overgrazed and fisheries over harvested, limiting the amount of additional food from these sources. Water bodies have suffered extensive depletion and pollution, severely restricting future food production and urban expansion. The stability of the atmosphere has been disrupted, with heat-trapping greenhouse gases increasing and the life-protecting ozone layer diminishing. And natural forests - which help stabilize the climate, moderate water supplies, and harbour a majority of the planet's terrestrial biodiversity - continue to recede.

It takes no stretch of the imagination to see that the human species is now an agent of change of geologic proportions. We literally move mountains to mine the earth's minerals, redirect rivers to build cities in the desert, torch forests to make way for crops and cattle, and alter the chemistry of the atmosphere in disposing of our wastes. At humanity's hand, the earth is undergoing a profound transformation - one with consequences difficult to grasp.

These trends are not altogether new. Human societies have been altering the earth since they began. But the pace and scale of degradation over the last several decades is historically new. Since 1950, three trends have contributed most directly to the excessive pressures on the earth's natural systems: the doubling of world population, a 250 per cent increase of per capita economic output, and the widening gap in the distribution of income. A search for the root causes of environmental decline reveals that the environmental impact of the human population, now 5.7 billion, has been vastly multiplied by economic and social systems that strongly favour growth of production and ever-rising consumption over equity and poverty alleviation; and that do not discriminate between means of production that are environmentally sound and those that are not.

The central conundrum of sustainable development is now all too apparent: population and economies grow exponentially, but the natural resources that support them do not. In recent years, the global problems of ozone depletion and greenhouse warming have underscored the danger of overstepping the earth's ability to absorb our waste products.

Less well recognized, however, are the consequences of running down the natural capital of essential renewable resources - especially land, water, and forests - and how far along that course we may already be. On the contrary, it is often advocated to switch from mineral to biological resources. This is not a viable strategy; the limits of emission sinks, biological and mineral resources are mutually linked. Stretching one of them usually results in shrinking the others.

At the initial stage of development up to the mid eighties, most developing countries, especially African countries, applied a centrally-planned market economy. Government's intervention in the market economy was most significant. The results thus far have not been satisfactory. Through the application of Structural Adjustments Policies as promoted by the IMF and the World Bank, many developing including African countries are shifting towards a more deregulated and decontrolled market economy. This is in particular true for the High Economic Performing Asian Economies, which have shown impressive achievements in the past years and for High Economic Performing African Economies which are termed "Successes" by the World Bank. The major cause of the East Asia miracle and of the African successes may perhaps lie in the reduced inefficiency in the management of the economy. Inefficiency is caused by market failure, referring to the failure of the market to reflect the full costs of production in the price of traded products and inputs. Inefficiency can also be caused by policy failures revealed by governments intervention, such as tax distortions, subsidies, quotas, interest rate ceilings and others which distort a well-functioning market, exacerbates an existing market failure, or fail to establish the foundations for the market to function efficiently. Both market and policy failures are also the causes of environmental destruction. Common resources are unpriced, waste and pollution have no markets. Environmental and use of natural resources costs are not captured by the governments in National Accounts when interfering in the markets. This is still the other side of the glittering coins of East Asia: the destruction of the environment is, as expected, vast. This applies even more specifically to Africa.

Many economists see no cause for worry, believing that the market will take care of any needed adjustments. As cropland, forests, and water grow scarce, all that is necessary, they say, is for prices to rise; the added incentives to conserve, use resources more productively, alter consumption patterns, and develop new technologies will keep output rising with demand. But once paved over for a highway or housing complex, or eroded, cropland is unlikely to be brought back into production - no matter how severe food shortages may become. Moreover, no market or price mechanism exists for assuring that an adequate resource base is maintained to meet needs that the market place ignores or heavily discounts -including those of vital ecosystems, other species, the poor, or the next generation.

Imports of biologically based commodities like food and timber are, indirectly, imports of land, water, nutrients, and the other components of ecological capital needed to produce them. Many countries would not be able to support anything like their current population and consumption levels were it not for trade.

In principle, there is nothing inherently unsustainable about one nation relying on another's ecological surplus. The problem, however, is the widespread perception that all countries can exceed their carrying capacities and grow economically by expanding manufactured and industrial goods at the expense of natural capital - paving over agricultural land to build factories, for example, or clear-cutting forest to build new homes. But all countries cannot continue to do this indefinitely. Globally the ecological books must balance.

The days of the frontier economy - in which abundant resources were available to propel production growth and living standards - are clearly over. We have entered an era in which global prosperity increasingly depends on using resources more efficiently, distributing them more equitably, and reducing consumption levels overall. And of course, the problem of food production capacity does not stand alone. On the one hand we have some potential threats which might develop equally, or even more, disastrous in the same time frame, i.e. global warming. On the other hand, in large parts of the world the traditional problems of sanitation and safe water supply already create such a burden that we can consider these problems as being over the threshold of sustainability. Unless we accelerate this transition, we risk exceeding the plant's carrying capacity to such a degree that a future of economic and social decline will be impossible to avoid.

In economic circle, it is now generally accepted and appreciated that development process as conventionally understood in the past four decades, namely, economic growth and the conditions supportive of growth, does not invariably or inevitably entail lasting improvement in the quality of life of the people as a whole. Increasingly, recommendations are been made for national development strategies, policies, plans and programmes, to be oriented towards a more "people-centred" approach in a more holistic manner including a better understanding of the social issues confronting the African region.

It is now also widely accepted and recognized that economic growth in itself is not sufficient to bring about the qualitative economic and social transformation demanded by the African people. African governments need deliberate policy interventions to ensure sustained economic development with transformation in a fair and equitable manner to raise African people's quality of life. Economic growth on its own will not alleviate poverty. The poor do not benefit automatically from a "trickle down" of new wealth, as shown by continuing poverty in the region despite decades of assistance to Africa.

To alleviate poverty on its own, growth would have to be consistently much higher than is likely. Economic growth will reduce poverty only if it utilizes and benefits the poor. For many countries of the region, this means that initially it should involve labour-intensive, and definitely rural investment. Equity in wealth distribution which is also important can be realized through taxation, or programmes targeted at the poor, including primary health care, water supply and sanitation, education, micro-enterprises and community development.

Interactions between environmental, population and poverty factors are worth noting. Owing to population pressure and the lack of employment opportunities, the poor are often forced into farming marginal or degraded land which cannot sustain them adequately. Poor environment thus contributes to their poverty. Especially with their larger families, the poor have few alternatives but to overgraze grasslands, misuse what agrochemicals they can get, deplete timber reserves and over-exploit water and soil resources. While their efforts permit short term survival, an important and understandable goal, they also lead to environmental degradation, insecurity about food and increased longer-term poverty. Thus poverty and population growth contribute to further environmental degradation. In some cases, specific incentives may be required to encourage the rural or urban poor to move out of dangerous or degraded environments.

The efficiency with which the wealth generated through natural resources is used in the present affects future generations. If natural resources are used for sustainable development, the effects on the quality of life of future generations is likely to be more positive than if the wealth generated is channelled into high levels of present consumption that are not sustainable in the long run. Thus the manner in which societies transform the natural environment and treat the wealth harvested bears directly on the degree to which the quality of life can be maintained or improved over time.

The World Commission on Environment and Development defined Sustainable Development as "*development that meets the needs for the present without compromising the ability of future generations to meet their own needs*". This definition, brings out the notion that the process of improving the quality of life of people, the present living standards should not be at the expense of the quality of life, the living standards of the future which is something few would disagree with. As with most concepts, however, it is not the broad term that is most informative but its operational content. The latter is encapsulated in three working rules or policies that are essential if such development is to be achieved. One is to do with equity. A declining and degraded natural resource base is more likely to result if the interests and needs of the poorest sections of poor societies are not satisfied. Hence Sustainable Development requires, "help for the very poor because they are left with no option other than to destroy their environment". A second working definition is that of resilience, or the capacity of a system to maintain its structure and patterns of behaviour in the face of external disturbance. This requires an ability to adapt to stresses and shocks and is of particular relevance to agriculture. A third working rule is based on the notion of efficiency in the use of resources. Sustainable Development also requires and efficient use of existing natural resources in the sense that the greatest value must be obtained from any given input. The concept of sustainability appears very fluid.

As with most concepts, it is not the broad term that is most informative or useful but its operational content. Although definitions of Sustainability abound, there are very few operational ones that would help guide policy in the direction of Sustainable Development.

If living standards are not to decline over time, future generations must have access to as effective a resource base as present generations. But the 'effectiveness' of a resource base depends on technology and that is an unknown as far as the future is concerned. It also depends on how the components of the resource base complement each other in providing the needs and wants of future generations. These components include man-made capital, exhaustible resources and renewable resources. If future generations are left with a total capital stock that is valued, in money terms, as much as the present one, is that enough, independent of how that stock is made up?

These issues are at the heart of deriving an operational definition of sustainable development. There are problems associated with uncertainty and with the complementarity of man-made and environmental capital. Many environmental economists would be unhappy with a working definition of sustainable development that translated itself as saying only that the total value of the capital stock must not decline overtime. Their main concerns would be that the valuation of the environmental capital would be inadequate to ensure it sufficient importance in the make up of the total. Furthermore, they would argue that many components of the environmental capital stock have a natural limited capacity which must not be exceeded. If it is, the damage done would be very large, as ecosystems fall apart and habitats are destroyed. One way in which these concerns might be incorporated into an operational definition, is to derive, in addition to a value of the capital stock, a set of indicators of environmental resources, the use of which must not be exceeded at any time. Such indicators could be developed using notions of discontinuity in the impacts of resource use and economic activity on the environment. No formal definition exists at that level but many of the ideas expressed in recent work are consistent with such a definition.

It is true to say that there is no agreed operational definition of Sustainable Development at present. Apart from indicating a preference for conservation, and being against the destruction of natural habitats, it would appear then to have little to offer. However, individuals have proposed a number of working rules or policies that they argue are essential if such development is to be achieved especially in the Agricultural Sector which appears to be the cornerstone of the Sustainable Economic and Social Development with Transformation of almost all African countries.

In order to achieve these working definitions of Sustainable Agricultural Development, there are three broad areas that can be identified.

The first is to value natural resources correctly. Such valuations should include all the services performed by them, including those that do not have any cash flows associated with them or that do not pass through any organised market. Doing this, provides the basis of ensuring that key elements in the natural resource and environmental make up are at least given due weight in the kinds of agricultural practices that are carried out.

The valuation process draws on an agricultural, scientific and socioeconomic database, and in turn feeds into two activities that constitute the second broad area: pricing and investment analysis. On the pricing side it allows decisions on pricing, taxation and subsidies and other instruments to be taken in a more rational manner. On the investment side it feeds into the project appraisal activities that determine how capital funds are allocated between development activities, and between development activities and others related to environmental protection and conservation.

The second is the necessity for the right economic valuations; but they are not sufficient to ensure Sustainable Development. In addition the appropriate legal and social framework has to be in place. This second broad area for a policy framework requires a careful evaluation of how and why existing systems have evolved and what the direct and indirect impacts of attempting them might be. The economic and the social and legal policies need to act together to ensure a more sustainable resource use.

A third area, related to the first, is that of environmental accounting. Earlier it was stated that at least one definition of Sustainable Development was that the future should not be left with a smaller resource base than the present. Following on from that is the notion that per capita consumption (as a measure of living standards) should not decline over time. This can be measured using a notion of net sustainable income but requires the national accounting framework to be adapted to take account of environmental and natural resources that are not normally valued in the national accounting framework. But national accounting systems are not only based on monetary values. They also look at the physical stocks of resources and their movement over time. In this respect they can be issued as part of a set of sustainability indicators, picking up the issues that valuations of resources do not (and cannot) always address.

The approaches to the economic measurement of environmental benefits can be broadly classified as direct and indirect techniques. The former considers environmental gains - an improved level of output in agriculture, better levels of air quality or water quality etc. - and seeks directly to measure the money value of those gains. This may be done by looking for a surrogate market or by using experimental techniques.

Indirect procedures for benefit estimation do not seek to measure direct revealed preferences for the environmental good in question. Instead, they calculate a 'dose-response' relationship between pollution and some effect, and only then is some measure of preference for that effect applied. Examples of dose-response relationships include the effect of pollution on health; the effect of pollution on aquatic ecosystems, and the effect of soil erosion on agricultural yields.

Indirect procedures do not constitute a method of finding Willingness to Pay (WTP) for the environmental benefit (or the Willingness to Accept (WTA) compensation for environmental damage suffered). What they do is to estimate the relationship between the 'dose' (pollution) and the non-monetary effect (health impairment, for example).

Although they have this obvious weakness, they are, nevertheless, frequently used in valuing environment changes, especially in developing countries, where the information available often only permits the use of such methods and data for the calculation of preference based estimates is poor.

Economic policies that have an effect on Sustainable Agriculture can be divided into four groups. First there are those that determine the broad parameters of economic policy nationally such as the exchange rate, monetary and fiscal policy. They are generally classed as macroeconomic policies. Second there are policies that directly affect activity in specific agricultural sectors, such as input price policies, output price polices, and user charges for services provided by the public sector. As a group these would be classed as microeconomic policies. Third there are policies that determine the functioning of markets, such as which natural resource products can be bought and sold and what trades are permitted. Such market policies are closely related to the legal and social practices that define and circumscribe the action of property rights. Fourth, there are policies directly designed to control resource degradation and reduce environmental pollution. Such policies are enacted through a range of environmental instrument, from command and control to sophisticated fiscal schemes acting on economic incentives. Each of these is considered briefly below.

There is considerable scope for the use of some of direct techniques in the valuation of environmental benefits in African countries, and in their rural sectors, but this has yet to be substantially exploited. Particular promise holds for contingent valuation methods and travel cost approaches. However, it is essential to note that such models really only provide 'orders of magnitude' to the size of the benefits, and that some inaccuracy is inherent in the nature of the task being attempted. Nevertheless, the values obtained are useful in reaching rational decisions with regard to investments involving such benefits.

In order to overcome the failures underlined previously, and to prevent environmental destruction, it is suggested *"that the most cost-effective intervention for mitigating market failures is to improve the functioning of the market by eliminating policy induced distortions, establishing secure property rights over resources, internalizing the costs of external side effects through pricing and fiscal instruments, encouraging competition, allowing the free flow of information, and reducing uncertainty through more stable and predictable policies and politics"*. This suggestion implies that environment is merged into economic development, which provides the base for sustainable development. In line with this development, current National Income measures have to be reviewed and adjusted.

Stated simply, the problem is that the production of goods and services as measured by the GDP, although it is an important factor in creating welfare, gives an incomplete picture: if the picture is to be completed, other factors must be taken into account, too. Today, the international debate centres around proposals for bringing more elements of welfare into the System. The problem of most of the proposals is quantification.

As stated earlier, the boundaries of the System are simple and clear: transactions should be measurable in terms of market prices and/or a real flow of money in the opposite direction of the flow of goods or services. For most of these welfare elements, quantification means that assumptions must be made, in turn implying that (subjective) valuations often start to play a role.

It become increasingly clear that the National Accounts provide insufficient information on environmental resources. As the unpleasant effects of growth in this area have multiplied, quantitative information on many kinds of pollution have been developed, as have government policies aimed at stemming the tide. The idea of an alternative estimate of the GDP that would account for these negative effects has been around for some time. For this purpose the so-called National Accounting Matrix (NAM) was developed in the Netherlands, including Environmental Accounts (NAMEA). In the NAMEA environmental indicators are put on a par with the major aggregates in the National Accounts, such as the National Income. Extra rows and columns are added in the National Accounts Matrix for information on emissions of toxic substances, supply and reuse of waste, production and use of raw materials and energy, and, in principle, the use of land, water and air. The environmental indicators reflect the goals of the environmental policies of the government. The NAMEA is suitable for use as a database for modelling the interaction between the national economy and the environment. A further step will be the calculation of environmental losses, based on the NAMEA. This is the subject of a project called Sustainable National Income (SNI), which is one of the major challenging messages of this paper.

It is unfortunate that, data pertaining to the quality of the physical environment in Africa are for the most part scant, difficult to access and often difficult to interpret. Such data are commonly accorded low priority in the national statistical budgets of almost all countries in the region, especially where statistical manpower and financial resources are limited. Where data are available, difficulties also arise because standardized reporting systems on the natural or built environment are still in their infancy.

Physical environment data can be categorized into two closely related sets of variables: those with an immediate impact on the quality of life and those with a longer-term or delayed impact. Among the immediate impact variables are living space per person, sanitation services, supply of safe water, electricity supply and transport and communications. Among the delayed impact variables are deforestation, land degradation, fauna and flora species extinction, depletion of the ozone layer and the so-called greenhouse effect. The immediate impact variables tend to correlate positively with national income and economic growth, while the delayed impact variables tend, in general, to worsen as per capita income rises.

As already explained above, the concept of economic growth as a means to overcome scarcity/poverty may have its roots in the seventeenth century, but it was not until very recently that societies began to analyze their economic activities in order to support the promises of governments to create employment and income and to increase wealth and welfare on a Sustainable manner. It could also be said that, the concept of National Income is a young branch on the tree of economic thought, but it has gained such weight that we hardly realise that until only very recently it played no role at all.

However, foremost, there is an urgent need to examine the environmental issues arising in various agricultural and natural resource eco-systems. These include pastoral systems, extractive systems (e.g. forestry), and exploitive systems (e.g. irrigated agriculture and marginal cropland). In each case the systems are seen as having a range of possible equilibria, with the use of natural resources, after accounting for them and allowing for their regeneration, being consistent with the capacity of the systems to provide for and support certain animal and human populations. The shift away from such an equilibrium for social and economic reasons, or for reasons related to natural stresses and shocks, can result in unsustainable development. Whether the systems then returns to a new sustainable equilibrium or not will depend on how it responds internally to the disequilibria, as well as what external pressure are brought to bear on the system.

Section I

INTRODUCTION

"This is precisely the time to dream the best dream of them all, that no people will know starvation that tyranny will not be able to exist unpunished, that liberty be given a more glorious song, that the human race - after so long standing in shame at its failed possibilities should now move towards a new millennium, where overcoming our pettiness and our fears, we might begin to astonish even the gods."

Ben Okri (Nigerian Writer)

As its title indicates, this document is concerned with the providing a consistent analysis of what constitutes sustainable agricultural development and how it can be brought about by appropriate economic, legal and social policies. Given that there are no limitations in terms of geography or in terms of which agricultural activities are to be included, the task is indeed a daunting one. If, therefore, the document is not to flounder in generalities, it is necessary to circumscribe its objectives, beginning with what it does not cover. It is not a detailed evaluation of the economic and environmental impacts of agricultural policy in African countries. Nor does it provide a comprehensive review of all instruments that impact on the agricultural sector - taxes, land reform policies, pricing policies, macroeconomic policies and so on. Instead it concentrates on the notion of sustainability and sustainable development (within the framework of Agenda 21) and how they relate to the agricultural sector. From the concept of sustainability one can identify some key general policy reforms and actions that are necessary to achieve that goal. These relate to how decisions are made and the framework within which they are made, rather than detailed prescriptions for policy in each sector.

Given a working definition of sustainable agricultural development, the document describes briefly: 1) the history and roots of growth; 2) the Economic Growth and Gross National Product; 3) the consequences of unsustainable

development in key sectors - pastoral systems, extractive systems (such as forestry) and exploitive systems (such as marginal cropland). This helps to flesh out the idea of sustainability in agriculture and, along with the policy framework defined above, provides the background for a more detailed evaluation of how, within the framework of the "African Common Position", implementing the broad policies has, and can continue to, aid the process of sustainable agriculture. The discussion of policies and instruments in the context of specific sectoral issues is partly empirical and partly prescriptive, recommending policies that should help sustainable development and arguing against ones that would militate against such development.

Even with these restrictions, the scope of this document is very wide and many topics can only be touched upon. Extensive references to other documents and sources of material are made in the document but the literature is so vast that important ones, particularly non-economic references, may well have been left out. The same also applies to detailed sectoral policies for sustainable development, where the contributions of the sectoral studies should be very useful in complementing this contextual study.

In economic circle, it is now generally accepted and appreciated that development process as conventionally understood in the past four decades, namely, economic growth and the conditions supportive of growth, does not invariably or inevitably entail lasting improvement in the quality of life of the people as a whole. Increasingly, recommendations are been made for national development strategies, policies, plans and programmes, to be oriented towards a more "people-centred" approach in a more holistic manner including a better understanding of the social issues confronting the African region.

Humankind has historically sought to modify and control its habitat, giving rise to increasingly "artificial" environments. While generally promoting the quality of life, such changes generate unanticipated, often detrimental, environmental consequences. In recent years, growing concern over the environmentally deleterious effects of current development processes throughout the Africa Region has raised the question of sustainability of such development process. Mankind's relationship with the natural environment has traditionally been adversarial in character, emphasizing exploitation, whereas its relationship with the built (consisting of the infrastructure created to

support human activity) environment has emphasized enhanced compatibility and improvement.

At the initial stage of development up to the mid eighties, most developing countries, especially African countries, applied a centrally-planned market economy. Government's intervention in the market economy was most significant. The results thus far have not been satisfactory. Through the application of Structural Adjustments Policies as promoted by the IMF and the World Bank, many developing including African countries are shifting towards a more deregulated and decontrolled market economy. This is in particular true for the High Economic Performing Asian Economies, which have shown impressive achievements in the past years and for High Economic Performing African Economies which are termed "Successes" by the World Bank. The major cause of the East Asia miracle and of the African successes may perhaps lie in the reduced inefficiency in the management of the economy. Inefficiency is caused by market failure, referring to the failure of the market to reflect the full costs of production in the price of traded products and inputs. Inefficiency can also be caused by policy failures revealed by governments intervention, such as tax distortions, subsidies, quotas, interest rate ceilings and others which distort a well-functioning market, exacerbates an existing market failure, or fail to establish the foundations for the market to function efficiently (Pearce and Warford, 1993). Both market and policy failures are also the causes of environmental destruction. Common resources are unpriced, waste and pollution have no markets. Environmental and use of natural resources costs are not captured by the governments in National Accounts when interfering in the markets. This is still the other side of the glittering coins of East Asia: the destruction of the environment is, as expected, vast. This applies even more specifically to Africa.

In order to overcome these failures and to prevent environmental destruction, it is suggested "*that the most cost-effective intervention for mitigating market failures is to improve the functioning of the market by eliminating policy induced distortions, establishing secure property rights over resources, internalizing the costs of external side effects through pricing and fiscal instruments, encouraging competition, allowing the free flow of information, and reducing uncertainty through more stable and predictable policies and politics*" (Panayotou, 1993). This suggestion implies that environment is merged into economic development, which provides the base for

sustainable development. In line with this development, current national income measures have to be reviewed and adjusted (Ahmad, et al., 1989).

In order to move from conventional development towards sustainable development as elaborated above, Africa requires substantial resources to finance Environmental Adjustment Policies and Programmes which contain policies and programmes:

- to meet the developmental challenges;
- to meet the environmental challenges;
- to enhance resource use management;
- to enhance pollution control and waste management;
- to reduce inefficiency in the management of sustainable development by correcting market and policy failures.

The efficiency with which the wealth generated through natural resources is used in the present affects future generations. If natural resources are used for sustainable development, the effects on the quality of life of future generations is likely to be more positive than if the wealth generated is channelled into high levels of present consumption that are not sustainable in the long run. Thus the manner in which societies transform the natural environment and treat the wealth harvested bears directly on the degree to which the quality of life can be maintained or improved over time.

It is unfortunate that, data pertaining to the quality of the physical environment in Africa are for the most part scant, difficult to access and often difficult to interpret. Such data are commonly accorded low priority in the national statistical budgets of almost all countries in the region, especially where statistical manpower and financial resources are limited. Where data are available, difficulties also arise because standardized reporting systems on the natural or built environment are still in their infancy.

This argues for sound strategies for people in Africa because they have so few degrees of freedom, but it also certainly argues for looking again at the consumption patterns in the North. And by that, we do not mean going back to the horse and buggy days. Switzerland, which by no stretch of the imagination is a deprived

country, has a water consumption per capita that is about one-fifth that of the United States. On energy consumption levels, the difference between Switzerland (or Japan for that matter) and the United States is also about one-half. The per capita consumption of energy in Africa, India or China is still a very small fraction of that in Switzerland or Japan. So the per capita consumption issues have to be looked at, and these argue for changes in the northern patterns, as much as they argue for sound practices in Africa in particular and in the South in general.

The same is true in terms of the global commons, and the contribution on the debt side, in terms of *pollution* and the use of the environment as a "sink". The contribution in terms of CO_2 emissions, or in terms of global waste production and pollution show the same types of disparities. They are also very large. Africa's per capita contribution of average annual tons of carbon emitted into the atmosphere is very small compared to Canada or the United States, and this is true of most developing countries, except for the former USSR, where levels are relatively high because of the nature of their industrial activities.

Such disparities encourage one to think in terms of tradeable permits. Low income countries with a large population could trade permits based on proportional population rights to use environmental services (both to consume and to pollute) with some of the richer countries. While this is not currently on the agenda of international negotiations, there is something there for all of us to reflect on.

Financial resources can be mobilized by forging North-South as well as South-South cooperation through trade, investment, technology transfer, capacity building, debt relief and fresh aid. The newly established World Trade Organization needs to remove the barriers that hinder the trade of increased value added products from the South (especially from Africa) to the North. The World Bank and the International Monetary Fund (IMF) need to reassess the economies also of the North to allow structural adjustments in their production and consumption pattern in order to allow free flow of investments into the South. Clean technology transfer needs to be promoted, renewable energy technology needs to be boosted. Human resource development and capacity building in sustainable development needs to be encouraged. The international financial institutions and creditor countries need to reduce outstanding debt and debt services to make these sources available for sustainable development. Finally, fresh aid can be mobilized by restructuring the tax

system to shift the tax burden from environmentally friendly activities such as income from investment in sustainable production and consumption. With this effort being implemented in the spirit of global partnership, it is possible to forge ahead with sustainable development as seen from the South. And moreover, formal accounting of aid flows is necessary: we propose a yearly World Bank/IMF report on the actual and final flows of aid flows and capital. These recommendations are in line with the "African Common Position" on the implementation of Agenda 21.

Poverty alleviation must be part of sustainable development as recommended in Agenda 21. The requirement for ecologically sustainable development and its facilitation by alleviating poverty and reducing population growth has already been agreed upon by African ministers responsible for the environment. The Cairo strategy provides a sound basis for national and regional action linking concerns about poverty, population and environment.

In the next Section the issue of Sustainability is discussed more specifically in the context of agricultural problems in African countries and generally in developing countries. Section III examines the role of valuation and how it impacts on Sustainable Agricultural Development. Section IV looks at economic, legal and social policies for Sustainable Development. Section V examines the inclusion of environmental factor into national accounting and its usefulness in pursuing sustainability in agriculture. Finally, Section VI concludes the document.

Section II

ECONOMIC GROWTH, SUSTAINABILITY AND SUSTAINABLE DEVELOPMENT

"Sustainability demands the creation of a political order in which, firstly, control over the natural resources rests to the maximum entente possible, in the local communities, who are dependent on those resources; and secondly decision making within the community is as participatory as possible."

Anil Agarwal
"What is Sustainable Development"
in Towards a Sustainable Society
ed. by M.L. Dewan, 1995

1. The Concept

It is now widely accepted that over the long term, development process must be supported by sustained economic growth and transformation. Only a dynamic economy can mobilize the necessary resources to permit the redistribution of income and wealth and the provision of basic social services demanded by the large masses of African people through the region.

The World Commission on Environment and Development defined Sustainable Development as "*development that meets the needs for the present without compromising the ability of future generations to meet their own needs*" (1). This 'definition' of sustainability concept, which incidentally leaves the meaning of the word 'development' undefined, brings out the notion that the process of improving present living standards should not be at the expense of the living standards of the future. At one level this must be regarded as a universally acceptable proposition - who would be willing to recommend a development path that guaranteed lower living standards to future generations? However, at a deeper level it is the trade-off of present against future welfare that is being debated here. Should a society be willing

to accept lower welfare now, so that future generations can enjoy a permanently higher welfare and what exactly is the trade-off? Or how does one trade-off the possibility of a slightly lower welfare in the future against the certainty of higher welfare now? Growth models in economics have long been concerned with such questions. What the concept of Sustainable development does, is to place a limit on that kind of 'trading-off'. It states that Society should never be willing to countenance a policy which implies a decline in living standards in the future. In that sense it is a non-trivial proposition.

As with most concepts, it is not the broad term that is most informative or useful but its operational content. Although definitions of Sustainability abound,(2) there are very few operational ones that would help guide policy in the direction of Sustainable Development. If living standards are not to decline over time, future generations must have access to as effective a resource base as present generations. But the 'effectiveness' of a resource base depends on technology and that is an unknown as far as the future is concerned. It also depends on how the components of the resource base complement each other in providing the needs and wants of future generations. These components include man-made capital, exhaustible resources and renewable resources. If future generations are left with a total capital stock that is valued, in money terms, as much as the present one is that enough, independent of how that stock is made up?

These issues are at the heart of deriving an operational definition of sustainable development. There are problems associated with uncertainty and with the complementarity of man-made and environmental capital. Many environmental economists would be unhappy with a working definition of sustainable development that translated itself as saying only that the total value of the capital stock must not decline overtime. Their main concerns would be that the valuation of the environmental capital would be inadequate to ensure it sufficient importance in the make up of the total. Furthermore, they would argue that many components of the environmental capital stock have a natural limited capacity which must not be exceeded. If it is, the damage done would be very large, as ecosystems fall apart and habitats are destroyed. One way in which these concerns might be incorporated into an operational definition is to derive, in addition to a value of the capital stock, a set of indicators of environmental resources, the use of which must not be exceeded at any time. Such indicators could be developed using notions of discontinuity in the

impacts of resource use and economic activity on the environment. No formal definition exists at that level but many of the ideas expressed in recent work are consistent with such a definition. They are discussed later in this document.

It is now also widely accepted and recognized that economic growth in itself is not sufficient to bring about the qualitative economic and social transformation demanded by the African people. African governments need deliberate policy interventions to ensure sustained economic development with transformation in a fair and equitable manner to raise African people's quality of life.

It is true to say that there is no agreed operational definition of Sustainable Development at present. Apart from indicating a preference for conservation, and being against the destruction of natural habitats, it would appear then to have little to offer However, individuals have proposed a number of working rules or policies that they argue are essential if such development is to be achieved. Of these, three are singled out as being important in the context of this discussion.

The First one is to do with equity. It is argued that a declining and degraded natural resource base is more likely to result if the interests and needs of the poorest sections of poor societies are not satisfied. Hence Sustainable Development requires, "*help for the very poor because they are left with no option other than to destroy their environment*" (Tolba, 1987). The linkage between poverty and the environment, however, is not as clear as is implied by that statement and there is some evidence to indicate that the role of equity as a means of achieving sustainability might be an inappropriate focus of policy. This question is taken up later when policies for Sustainable Development are discussed.

A second working rule for Sustainable Development is that of resilience, or the capacity of a system to maintain its structure and patterns of behaviour in the face of external disturbance. This requires an ability to adapt and is distinguished from ecological sustainability, which refers to the capacity of a system to maintain its equilibrium in response to normal fluctuations in the environment. The concept is of particular relevance to agriculture where it is used to define the sustainability of an agricultural system as its ability to maintain its productivity in the face of stress or shock. As Conway and Barbier state "*stress may be growing salinity, or erosion. ... A major event such as a new pest or a rare drought or a sudden massive increase in*

input prices would constitute a shock" (Conway, Barbier, 1989). If such systems lose their resilience they are rendered more susceptible to other shocks and hence it is considered as a necessary requirement of sustainable development that agro eco-systems maintain their resilience.

A third working rule is based on the notion of efficiency in the use of resources. Although many definitions of Sustainable Development does not directly address this issue, it follows from the fact that what is being pursued is Sustainable Development(3). Development implies improving the quality of life of people, rising living standards and the policies that are to be pursued have to be consistent with achieving the greatest improvements in living standards, subject to whatever constraints the sustainability criterion imposes. Sustainability must be social, economic and environmental (see figure 1). There are a number of models of great sophistication that define various criteria an economy should seek to maximise over time, and that characterise the path that any economy would take if it were to achieve those objectives (4). They operate at a high level of abstraction and do not have any direct policy guidelines that can be used in the context of this study but it is clear that, whatever the objective function, the pursuit of sustainable development will require an efficient use of existing natural resources. By efficient is meant that the greatest value must be obtained from any given input. To achieve this objective policy makers will have to use a variety of quite complex allocative mechanisms, including prices, taxes and other fiscal controls. They will also have to regulate resource use with a greater appreciation of the benefits and costs of the regulations.

In order to achieve these working definitions of Sustainable Agricultural Development, there are three broad areas that can be identified.

The first is to value natural resources correctly. Such valuations should include all the services performed by them, including those that do not have any cash flows associated with them or that do not pass through any organised market. Doing this, provides the basis of ensuring that key elements in the natural resource and environmental make up are at least given due weight in the kinds of agricultural practices that are carried out. The valuation process draws on an agricultural, scientific and socioeconomic database, and in turn feeds into two activities that constitute the second broad area: pricing and investment analysis. On the pricing side it allows decisions on pricing, taxation and subsidies and other instruments to be

taken in a more rational manner (5). On the investment side it feeds into the project appraisal activities that determine how capital funds are allocated between development activities, and between development activities and others related to environmental protection and conservation.

The second is the necessity for the right economic valuations; but they are not sufficient to ensure Sustainable Development. In addition the appropriate legal and social framework has to be in place. This second broad area for a policy framework requires a careful evaluation of how and why existing systems have evolved and what the direct and indirect impacts of attempting them might be. The economic and the social and legal policies need to act together to ensure a more sustainable resource use.

A third area, related to the first, is that of environmental accounting. Earlier it was stated that at least one definition of Sustainable Development was that the future should not be left with a smaller resource base than the present. Following on from that is the notion that per capita consumption (as a measure of living standards) should not decline over time. This can be measured using a notion of net sustainable income but requires the national accounting framework to be adapted to take account of environmental and natural resources that are not normally valued in the national accounting framework. But national accounting systems are not only based on monetary values. They also look at the physical stocks of resources and their movement over time. In this respect they can be issued as part of a set of sustainability indicators, picking up the issues that valuations of resources do not (and cannot) always address.

Figure 1 gives a comparison of social, economic and environmental sustainability while Figure 2 shows the broad policy areas and their relationships to each other and to the pursuit of a policy of sustainable development.

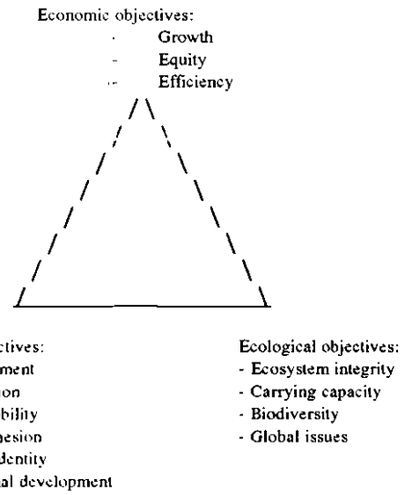
2. The History Roots of Growth and Sustainability

In order to understand the complexes and obsessions of individuals, it is often important to go back to their youth. The same may also hold for cultural epochs. In order to shed light on ideas about the necessity of material progress and economic

growth, which without exaggeration can be called the two central obsessions of Modernity, it is useful to look at their origins. In the cultural heritage of the West we find a standard account of these origins. It tells us that the beginning of Modernity, with its dreams of progress and growth, spelled out a new awakening for mankind. When we refer to the beginning of this period as "The Renaissance" or to a later phase as "The Enlightenment", this standard view is forcefully present in the names of these periods.

With the rise of post-modernism this standard account is coming under growing attack. In philosophy and the humanities the dark side of the beginnings of Modernity are drawing ever more attention. The confident and optimistic story of Modernity is slowly being unravelled and deconstructed, dreams are turning out to be nightmares, or at least attempts to keep nightmares out of sight, and promises are being unmasked as desperate responses to fears and anxieties instead of being simple beacons for a brighter future.

One of the main critiques of Modernity along these lines has been "Cosmopolis" by Stephen Toulmin. In this study the English philosopher undertakes to lay bare "the hidden agenda of Modernity". In his prologue Toulmin invites us to "back into the next millennium". The problems facing mankind at the end of the second millennium are warning us that the way straight ahead is no longer feasible. The old battle cries of Modernity no longer suffice. Rather, we should look back at the way the modern project was conceived and at the philosophical, social and economic assumptions on which it rested. In this sub-section, we undertake this task partially by looking at the idea of economic growth as an answer to anxiety and scarcity/poverty.



Social Sustainability ("SS")	Economic Sustainability ("EcS")	Environmental Sustainability ("ES")
ES needs SS - the social scaffolding of people's organisations that empower self-control and self-policing in peoples' management of natural resources (see Cernea, 1993). Resources should be used in ways which increase equity and social justice, while reducing social disruptions. SS will emphasize qualitative improvement over quantitative growth; and cradle-to-grave pricing to cover full costs, especially social. SS will be achieved only by strong and systematic community participation or civil society (Putnam, 1993 a, b). Social cohesion, cultural identity, institutions, love, commonly accepted standards of honesty, laws, discipline, etc., constitute the part of social capital that is least subject to measurement, but probably most important for SS. This "moral capital", as some have called it, requires maintenance and replenishment by the religious and cultural life of the community. Without this care it will depreciate surely as will physical capital.	The widely accepted definition of economic sustainability is "maintenance of capital", or keeping capital intact, and has been used by accountants since the Middle Ages to enable merchant traders to know how much of their sales receipts they and their families could consume. Thus the modern definition of income (Hicks, 1946) is already sustainable. But of the four forms of capital (human-made, natural, social and human) economists have scarcely at all been concerned with natural capital (e.g., intact forests, healthy air) because until relatively recently it had not been scarce. Also economics prefers to value things in money terms, so it is having major problems valuing natural capital, intangible, intergenerational, and especially common access resources, such as air etc. In addition, environmental costs used to be "externalized", but are now starting to be internalized through sound environmental polices and valuation techniques. Because people and irreversibles are at stake, economics has to use anticipation and the precautionary principle routinely, and should err on the side of caution in the face of uncertainty and risk. Human capital (investments in education, health, and nutrition of individuals is now accepted in the economic lifestyle (WDR 1990, 1991, 1995), but social capital, as used in SS, is not adequately addressed.	Although environmental sustainability is needed by humans and originated because of social concerns, ES itself seeks to improve human welfare by protecting the sources of raw materials used for human needs and ensuring that the sinks for human wastes are not exceeded, in order to prevent harm to humans. Humanity must learn to live within the limitations of the physical environment, both as a provider of inputs ("sources") and as a "sink" for wastes (Serageldin, 1993a). This translates into holding waste emissions within the assimilative capacity of the environment without impairing it. Also by keeping harvest rates of renewables within regeneration rates. Quasi-ES can be approached for non-renewables by holding depletion rates equal to the rate at which renewable substitutes can be created (El Serafy, 1991).
Note: Clearly these three concepts are related closely in parts. However, this document focuses more on environmental sustainability, rather than on sustainable development. The moment "development" is introduced, the discussion becomes quite different, and thus is left for another occasion.		

Figure 1: Comparison of social, economic and environmental sustainability (from: Serageldin 1993a, b).

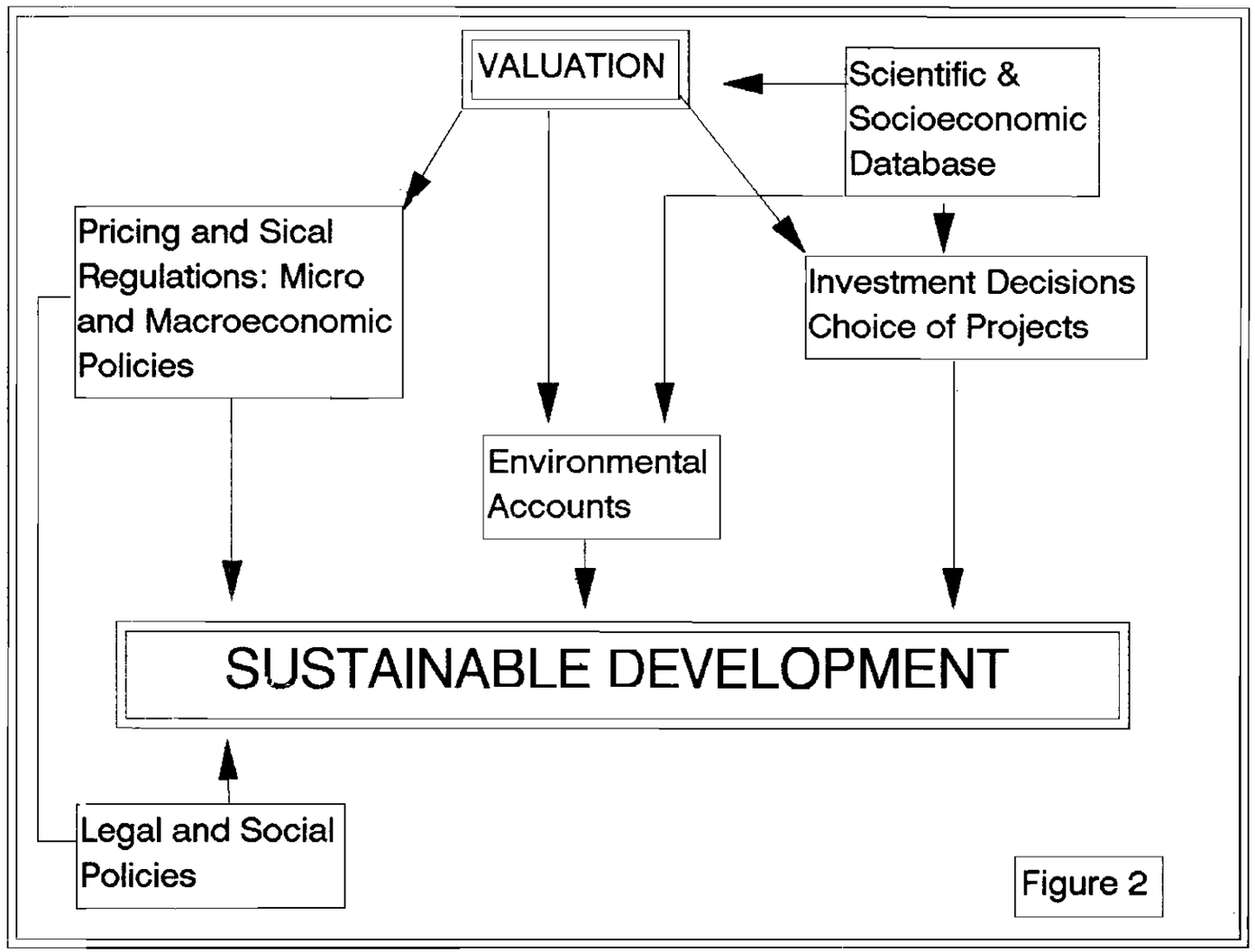

VALUATION
Scientific & Socioeconomic Database
Pricing and Sical Regulations: Micro and Macroeconomic Policies
Investment Decisions Choice of Projects
Environmental Accounts
SUSTAINABLE DEVELOPMENT
Legal and Social Policies

Figure 2

2.1 Ancient fears

Toulmin's main critique of the standard account is that it is historically untenable. He shows *in extenso* that the period during which the first ideas of the Enlightenment originated was not accompanied by the quiet and optimistic mental climate that is often assumed. The first half of the seventeenth century should rather be seen as being among the most uncomfortable, and even frantic, periods in the whole of European history. It was a time of turmoil and crisis and the ideas of Modernity to emerge at that time can be seen as answers to this severe crisis. Certainly, those answers were effective; but according to Toulmin they also masked some of the essential characteristics of that crisis. Three hundred years later we are facing partly the same crisis once more, and this time we cannot run away from it by falling back on the old answers, even though we are still fascinated by them.

The same analysis that Toulmin expounds for the seventeenth century we find with many historians who treat the whole period of the beginning of Modernity. As an illustration one can mention "La peur en Occident", a celebrated study by the French historian Jean Delumeau. He characterizes the transition from the Middle Ages to modern times as an era of many and major perturbations. From the middle of the fourteenth century, there was a multiplication of fears all over Europe. Fear of the devil, fear of women, of Jews, strangers, nature and death are some of the themes treated by Delumeau. Compared with earlier and later periods, in that era there was a respectable proliferation of fright of all shapes and sizes. In this context, completely new enemies were invented, exemplified not only by the witch-hunts and the persecution of Jews, but also by the idea that nature is the enemy of man, to be defeated and subdued, an idea that dates back to the beginning of the modern era.

According to Delumeau, the many anxieties of the late Middle Ages - also described by the Dutch historian Huizinga in his famous "The Waning of the Middle Ages" - can be attributed largely to the loss of traditional structures and attitudes. The moral vacuum at the end of the Middle Ages made way for fear. The traditional answers to major existential questions were no longer taken for granted and lost their legitimacy as culture failed to provide new responses.

Delumeau's approach shows that the belief in progress served largely as compensation for the veiled fears of the era. The beautiful dream of better times is

just one side of the coin. Equally, the optimism served as a mechanism for exorcising fright. Western culture has been driven not only by the allusion to a continuously improving quality of life, but also by repressed fears.

In the great philosophical systems of the seventeenth century the social reality of fear is clearly reflected. Most of the fears and anxieties of that era can be summarized under the concept of scarcity/poverty. In the middle of the century Thomas Hobbes, who called himself "*a child of fear*", starts considering "*the natural condition of mankind as one of 'continual fear' in which the life of man 'is solitary, poor, nasty, brutish and short'*". And at the end of the century John Locke, who is often considered to be the grandfather of our modern economy, is also obsessed by the idea of a permanent scarcity/poverty with which mankind is faced. In contrast to Hobbes, however, he suggests a way out of this situation by formulating new ideas on growth, progress and expansion, concepts which before had never really existed. In order to understand the force and the appeal of these ideas it is necessary to turn to the analyses of these two philosophers.

(a) Hobbes: power as a comparative phenomenon

The philosophical articulation of the reality of scarcity/poverty, a phenomenon that was largely unknown before Modernity, starts in the seventeenth century with the ideas of Thomas Hobbes. The best approach to the subject can be found in the famous theory of power developed by Hobbes in his major study "Leviathan". According to Hobbes power manifests itself in all kinds of social institutions and structures. Like Michel Foucault in our century he already states that every social phenomenon is based on power relations between individuals and groups. For Hobbes power is a comparative phenomenon. It originates from a comparison between different individual people. The goods, the objects one seeks to obtain, are not pursued for their own sake, but because someone else is also keen to obtain them. When Hobbes talks about "covetousness", the "desire of riches", he remarks that this "*name is always used in signification of blame*". The reason for this is "*because men contending for them (riches), are displeased with one another attaining them*". The causal connection Hobbes is suggesting here is based on comparison. It is clear that people do not desire riches because they want them directly for themselves. Riches are important only in comparison with what others have. The possibility of being

content with the riches one possesses seems to be excluded, for otherwise it is difficult to understand the fact that if others are rich, this is a source of displeasure.

Starting from this triangular comparative principle, society for Hobbes becomes a large arena of conflicts. "*Competition of riches, honour, command or other power enclineth to contention, enmity and war: because the way of one competitor to the attaining of his desire is to kill, subdue, supplant, or repel the other.*" That for Hobbes society is a zero-sum game is evident. Everything one attains is realised at someone else's expense. The power that people desire is always power over others, power at the expense of others. Or to state it finally in terms of the concept we are exploring here, because of the comparative relations between people, everything in Hobbes' universe potentially becomes a scarce good. His definition of power makes it impossible for there ever to be enough of it.

According to Hobbes scarcity/poverty, the relation between limited means and unlimited ends, is caused by the continuous comparisons and strife between individuals and groups. The ends are unlimited because one must always surpass the ends of others. As a philosopher Hobbes reflects on a new kind of social relations he sees emerging in his time. Most modern scholars agree that in the work of Hobbes we see a radical break with his philosophical predecessors. The world of Plato, Aristotle and the medieval thinkers he turns upside down, a radical break that is best reflected in the emergence of the theme of scarcity/poverty. Before the rise of modern economic society no one had suggested that unlimited desire was a natural quality of man. Scarcity/poverty arising out of this limitless, triangular desire is in this general sense an invention of Modernity. This is not to deny that the European Middle Ages, in common with non-Western cultures, experienced many periods of shortage and insufficiency. Until the nineteenth century, though, even in Western-Europe the word "scarcity/poverty" generally expressed an episode of shortage, a period of insufficiency, a dearth. Only at the end of the nineteenth century did the concept of scarcity/poverty start to signify a general condition of mankind. This modern usage of the term is already foreshadowed in the work of Hobbes, who reflected and conceptualized the radical rupture in the history of mankind that consisted in the emergence of Modernity.

Society for Hobbes becomes a life-boat in which all the passengers are fighting one another, not a culture as we know it traditionally. Survival, not the good, the

right life, becomes the ultimate value. The fear of scarcity/poverty always compels one to be the first to strike or throw out the other. The relations between individuals and groups that Hobbes describes as war and that we conceptualise here as scarcity/poverty, are characterized by feelings of fear, competition and envy. Fear is especially predominant for Hobbes. Fear largely regulates human behaviour. In order to escape fear, by covenant, men create "the great Leviathan", a semi-absolute state that keeps its subjects in awe and that prevents the permanent scarcity/poverty from developing into outright war.

(b) Locke: growth and expansion

By the end of the seventeenth century, modern images of nature and the idea of unlimited progress and growth are being described by John Locke, who is aware of the threat of scarcity/poverty, describing it as a state of war. But since he does not accept that scarcity/poverty originates in human social relations, he can suggest a way out. His view of scarcity/poverty became the accepted view of Modernity, which is that scarcity/poverty is an economic, a quasi-natural fact, a perpetual relations between mankind and nature. For him scarcity/poverty simply spells out the fact that earth and nature fail to provide enough for all. Therefore we only have to produce more to alleviate scarcity/poverty or even to put an end to it. Economic growth and expansion are the answers to the threat of scarcity/poverty. With Locke mankind, that is Western mankind, starts a rush forward in order to escape scarcity/poverty.

In this rush forward, nature - which by Hobbes, however mechanical a philosopher he may have been, was still seen as our "common mother" - becomes the prime enemy of mankind. Nature does not provide enough and man has to struggle and labour with her, to subdue the earth, in order to produce more and more. In the many comparisons of Locke in his "Second Treatise", nature loses its traditional connotations, it is devalued at the expense of labour. Locke wonders what the difference is between an acre of land planted with tobacco or sugar and an acre of the same land lying fallow without any husbandry. When the reader makes this comparison he will find out "*that of all the things useful to the life of man, when he divides what in them is purely owing to nature and what to labour, he shall find that in most of them ninety-nine hundredth were wholly to be put on the account of*

labour". In Locke's philosophy the themes of progress and of the devaluation of nature are closely linked with the fear of scarcity/poverty. The European Enlightenment and the myth of progress can thus be partly interpreted as a flight forward away from scarcity/poverty.

The same can be said of European expansion. For Locke, America was an empty continent that could help alleviate the effects of scarcity/poverty in Europe. Colonialism and expansion find their legitimacy in the quest to alleviate scarcity/poverty. Cecil Rhodes, the greatest imperialist of the last century, openly stated that imperialism was necessary to avoid a class war in England. And he already dreamt about the necessity of an ongoing expansion to the universe. "*I would annex the planets if I could*," he writes. To give one more example, former President Reagan in his speech at the launching of the Discoverer, after the failure of the Challenger, told the American people that *we have to conquer space in order to overcome "war, scarcity and misery on earth*". The argument is exactly the same as that given by Locke in the seventeenth century.

Unlike Locke, Hobbes never saw the flight forward into "empty" space as a possible way to escape scarcity/poverty. In Chapter 24 of "Leviathan" he writes extensively about plantations or colonies, but nowhere does he suggest that the perpetual war among men can be solved by expansion. He knows that scarcity/poverty originates in human relations and that people trying to escape it will inadvertently spread and propagate it till the ends of the earth and even into outer space.

2.2 The original myth of the modern economy

In comparing Europeans, who have subdued nature by way of rational labour, with Africans, or native tribes such as the American Indians, Locke wrote that the latter "*are rich in land, but poor in all the comforts of life*", because they do not work. They have the same fertile land, "*yet, for want of improving it by labour, have not one hundredth part of the conveniences we enjoy, and a king of a large and fruitful territory there feeds, lodges and is clad worse than a day labourer in England*".

In this kind of comparison we already discern the original myth of the modern economy. According to this myth, which was to be elaborated fully later in the eighteenth century by Adam Smith, scarcity/poverty is the original condition of all humankind, a condition with which humanity must wrestle, first in order to survive, later to live in comfort. In this myth, the typically modern human stance towards a nature that is scarce and hostile is projected back onto the whole history of mankind. Nature becomes the scapegoat of Modernity, scarcity/poverty becomes the source of violence. It is not Hobbes' competitive desires that create scarcity/poverty; it is in nature that the very causes of scarcity/poverty lie, for that is where the resources lie. If mankind can subdue and conquer nature by labour, then peace and abundance will be his future lot.

It is important to appreciate the double role that money plays in Locke's principals of scarcity/poverty. On the one hand it is the invention of money that causes scarcity/poverty. On the other hand money is constantly luring men forward and as such holds out the promise of helping to overcome scarcity/poverty. Originally the world provided enough for everyone. It was solely the usefulness of things that counted and it was senseless to appropriate more of the earth's products than one could use. The rule of propriety, according to Locke, was "*that every man should have as much as he could make use of". And for Locke it is clear that this rule would still hold in his time were it not for "the invention of money and the tacit agreement of men to put a value on it, introduced by consent to larger possessions and a right to them*". When men decided "*that a little piece of yellow metal which would keep without wasting or decay, should be worth a great piece of flesh or a whole leap of corn, ..., the intrinsic value of things which depends only on their usefulness to the life of man was altered because now the desire of having more than man needed*" found a ready outlet. In this context Locke writes the famous phrase: "*Thus in the beginning, all the world was America*", in which his earlier expounded ideas about the way the plenty of this continent can overcome scarcity/poverty become manifest. However, he continues: "*for no such thing as money was anywhere known. Find out something that has the use and value of money*" ... and the gathering of possessions will start, along with an attendant increase in scarcity/poverty.

On the one hand, then, money is the cause of scarcity/poverty, by enabling everything to be translated into common terms. On the other hand money promises an end to scarcity/poverty and as such is the driving force behind the labouring of

mankinc. Mankind keeps on running forward because around the next corner a future of eternal abundance may always be lying in store. In the economic philosophy of Locke already, scarcity/poverty is the basic assumption underlying the economy, and economic growth is the central response to this assumption. The war of every man against every man can be averted by growth, it can be replaced by the economic war of mar kind against nature that in the end will bring peace, prosperity and abundance. The promise is clear; but behind the promise, the hidden fears stand perhaps even more prominent. Every time the promise is called into doubt, the fears make it all but impossible to question it in a rationally articulated fashion. Form the very start, rationality has never held a prominent place in the limits-to-growth debate. In the final count, belief in the promises of growth and expansion roots in a hidden far of scarcity/poverty, and rational debate hardly suffices to bring this fear out into the open, let alone tackle it.

2.3 Two economic positions

The inadequacy of rational analysis for grappling with the promise of growth comes out most clearly in some famous passages of what is perhaps the most important economic study of the 19th century. In his "Principles of Political Economy" John Stuart Mill gives extensive space to a treatment of the necessity of a stat cnary èconomy. These passages were already highlighted in "The limits to Growth", the first report for the Club of Rome, but it is worth recalling them here in another light. In that report Mill's words were used as a rational exhortation. Here we would rather quote them to demonstrate the inadequacy of a rational critique of the growth credo, be it made in 1848 or 1972. All Mill's assumptions and ideas in these passages are reiterated in today's theorizing about the steady state economy and the necessity of setting limits to growth. In a beautiful way Mill succeeds in summarizing the essential arguments that can still be found today in the debate on economic growth and how to escape from its intrinsic dangers. For this reason it is important to quote him extensively. The failure of Mill, perhaps the most influential economic thinker of the last century, to persuade his contemporaries can serve as a warning in contemporary discussions. Only by broadening the discussion, by raising it above the narrow rational economic context, do we have a chance of exposing and diagnosing our society's obsession with economic growth.

Economic growth is essential but not sufficient to ensure sustained social and economic development with transformation, and strategies should focus on "societies" and not only on "economies". The alleviation and elimination of widespread and debilitating poverty, the increase of productive employment and the reduction of increasing unemployment, the transformation of social structures, and the enhancement of social integration requires that economic growth and economic development with transformation should integrate social considerations and the international economic environment should afford sufficient opportunity to foster economic growth, sustained economic and social development with transformation.

> *"It must always have been seen, more or less distinctly, by political economists, that the increase in wealth is not boundless: that at the end of what they term the progressive state lies the stationary state, that all progress in wealth is but a postponement of this, and that each step in advance is an approach to it ... if we have not reached it long ago, it is because the goal itself flies before us. I cannot ... regard the stationary state of capital and wealth with the unaffected aversion so generally manifested towards it by political economists of the old school. I am inclined to believe that it would be, on the whole, a very considerable improvement on our present condition. I confess I am not charmed with the ideal of life held out by those who think that the normal state of human beings is that of struggling to get on; that the trampling, crushing, elbowing, and treading on each other's heels which form the existing type of social life, are the most desirable lot of human kind, or anything but the disagreeable symptoms of one of the phases of industrial progress..."*

The predicament described by Mill clearly resembles the scarcity/poverty that Hobbes and Locke were acknowledging in their century. People still "were struggling to get on" in order to reach the final goal of prosperity. Mill endeavours to show in a rational way that the goal is flying before them. He attacks "the mere increase of production and accumulation" as a lie. "*I know not why it should be a matter of congratulations that persons who are already richer than anyone needs to be, should have doubled their means of consuming things which give little or no pleasure except as a representative of wealth.*" Mill's plea for a steady state also runs counter to the idea that humanity must subdue nature in order to hasten the growth of production.

"*Nor is there much satisfaction in contemplating the world with nothing left to the spontaneous activity of nature; with every rood of land brought into cultivation, which is capable of growing food for human beings; every flowery waste or natural pasture plowed up, all quadrupeds or birds which are not domesticated for man's use exterminated as his rivals for food, every hedgerow or superfluous tree rooted out, and scarcely a place left where a wild shrub or flower could grow without being eradicated as a weed in the name of improved agriculture.*" Unlimited increase of wealth, according to Mill, devastates the earth and makes it lose its "pleasantness".

Finally, Mill tries to convince his contemporaries that in a steady state they would be far better off than in the present rush forward. "*It is scarcely necessary to remark that a stationary condition of capital and population implies no stationary state of human improvement. There would be as much scope as ever for all kinds of mental culture, and moral and social progress; as much room for improving the Art of Living and much more likelihood of its being improved, when minds cease to be engrossed by the art of getting on. Even the industrial arts might be as earnestly and as successfully cultivated, with this sole difference, that instead of serving no purpose but the increase of wealth, industrial movements would produce their legitimate effect, that of abridging labour.*" All these arguments of Mill seem rational enough. But they did not touch his contemporaries, exactly because they were only rational. Mill did not detect the hidden fears behind "the struggling to get on", he did not notice how a fear of scarcity/poverty in a certain sense compelled his contemporaries to continue down the well-trodden path. Because of this blind spot in his analysis, neither could he experience the force and deep appeal of the promises of growth. For him these were merely irrational and he considered it his duty to demonstrate their irrationality. This promise was not irrational at all, however, for, crucially, it offered a strategy for avoiding repressed fears and sentiments.

In our century, economists hardly reflect on the assumptions of their profession any more. They do not talk about fears and promises, they play the "in-between", providing their models and calculations. When they give free rein to philosophical reflection, however, the old themes reappear. And in the work of a leading 20th century economist the old promises gain new force, as he is so bold as to even mention a date for their fulfilment.

In 1930, John Maynard Keynes prophesied that within two generations industrial societies might finally realize what in his view had always been the goal of humankind: an end to the problem of scarcity/poverty. Keynes, seeing his contemporaries still struggling down the dark tunnel of scarcity/poverty, perceived a future that would bring light in the form of satisfaction of all their basic needs. When that day came, a change in moral codes would also be possible. "*We shall be able to rid ourselves of many of the pseudo-moral principals which have hag-ridden us for two hundred years, by which we have exalted some of the most distasteful of human qualities into the position of the highest virtues ... The love of money as a possession ... will be recognised for what it is, a somewhat disgusting morbidity, one of these semi-criminal, semi-pathological propensities which one hands over with a shudder to the specialists in mental disease." When scarcity/poverty is overcome we shall be able "to return" to the traditional virtues of mankind. "We shall honour those who can teach us how to pluck the hour and the day virtuously and well.*"

These well known phrases of Keynes have important implications that remained hidden for their author. First Keynes suggests that the tunnel of scarcity/poverty has a beginning. Before that beginning, somewhere in the past, virtuous living was apparently possible. With the coming of the modern economy, however, it seems that the world was turned upside down. The promise of the economy is that in the future it will again be possible to live humanely and virtuously. But Keynes warns his contemporaries that before that time comes, they should continue to live in their upside down world of scarcity/poverty. "*May be for another hundred years we shall have to tell ourselves and each other that honesty is mean and meanness is honest. Meanness is useful and necessary and honesty is not.*" Only the characteristics of meanness, envy, greed and competition can lead us ultimately out of the dark tunnel of scarcity/poverty. Starting form a Hobbesian analysis it becomes clear that the tunnel of scarcity/poverty rather resembles some kind of cyclone in which men become caught, spinning around in rivalry with one another and in the process creating more and more needs and desires.

The two generations as well as the greater part of the hundred years speculated on by Keynes have passed and scarcity/poverty is becoming an ever greater threat. It is one of the key words in the analysis of "Our Common Future", the report of the Brundtland Commission, and it is a central theme in every analysis of our environmental problems. But still the answer seems to be the same as Locke's:

economic growth. In order to understand why it is exactly this economic growth that is now creating scarcity/poverty, rather than alleviating it, we must take this historical elucidation to its final step.

2.4 Scarcity/poverty as a social construction

In a sense, the concept of scarcity/poverty was more or less "invented" in the seventeenth century; however, the term "invention" might suggest that at a given moment someone just thought up and propagated scarcity/poverty. It is more likely, however, that the modern economy autonomously created the idea of an ever present universal scarcity/poverty as the founding myth of modern society. The rise of "scarcity/poverty is better explained on the basis of the concept of social construction. Hobbes and Locke looked at their society and saw that something like scarcity/poverty was present in many human and social relations. In his "Second Treatise" Locke systematized the way the upper classes in England were already trying to escape from scarcity/poverty, but in the long run this presumed escape only reinforced scarcity/poverty and made it omnipresent. By pursuing ever more production, the whole of culture and nature was thus reduced to a field of scarce resources. Viewing the world in this way, and above all acting this way, Western society has succeeded in establishing the regime of scarcity/poverty in almost all spheres of social and personal life, worldwide.

To put it bluntly, by acting for several centuries upon the assumption that nature is just dead and worthless stuff that has to be managed by human labour and technology, we have almost succeeded in making it dead and worthless. By defining everything as a scarce resource and acting this out, we are in the long run making it so. Hobbes' analysis finally proves to be true. It is impossible to escape scarcity/poverty by growth and expansion. For three centuries Locke's solutions have carried great weight. As the twentieth century closes, Hobbes' diagnosis of scarcity/poverty is evidently more fundamental. We do not have to adopt "the great Leviathan" as a therapy for the problem of scarcity/poverty to acknowledge the depth of the diagnosis. Hobbes was not ashamed to label himself "a child of fear". We, in turn, should show no hesitation in uncovering the hidden historical and still extant fears behind the promises of economic growth. Only then will we be able to pose the crucial question: will economic growth, which is still seen as the main remedy for

alleviating scarcity/poverty, in fact propagate scarcity/poverty all over the world, to such an extent that finally this world will come to an end, "*not with a bang but a whimper*"? (T.S. Eliot).

3. Economic Growth, Gross National Product and Sustainability

The concept of economic growth as a means to overcome scarcity/poverty may have its roots in the seventeenth century, but it was not until very recently that societies began to analyze their economic activities in order to support the promises of governments to create employment and income and to increase wealth and welfare on a Sustainable manner. The concept of National Income is a young branch on the tree of economic thought, but it has gained such weight that we hardly realise that until only very recently it played no role at all.

3.1 Origins

The first studies on National Income stemmed from curiosity about the differences in economic strength among nations. In the seventeenth century Britain, Petty and King made comparisons between Britain, France and Holland (republished: King, 1936). Similar work was done in France, but for a long time there was no follow-up in either country. Around the beginning of the nineteenth century, interest in the subject revived. Metelerkamp (1804) visited several European countries and found fairly recent estimates for France, Britain, the Netherlands and Saxony. This was followed by another long period of silence in which neither national states nor economists seemed to be interested in the concept.

In the twentieth century the modelling and quantifying of national economies started to gain momentum. Interest in national income studies was stimulated by several new circumstances, such as the political will to steer economic development, particularly when there is a need to make due allowance for social consequences. There was also a need for a theoretical framework, to shed light on the coherence and interdependency of economic processes. The sheer availability of quantitative data on the economic process led to the creation of what we now call National Accounting,

the idea of a national barometer to tell us in what weather the ship of society will be sailing.

The Great Depression of the 1930s, which led to unprecedented unemployment rates, and - given the experience of economic conflicts in the First World War - the threat of another major war confronted governments with problems on a scale never before encountered. The theory of National Accounting was developed after World War I by Clark, Kuznetz and Leontief, who were active in the United States, and Keynes, Meade and Stone in Britain, while in Norway contributions were made by Frisch and Aukrust and in the Netherlands by Tinbergen and Derksen. Theories of quantification followed. By as early as 1920 an input-output table for the Russian economy had been constructed, but it was not used as a basis for economic policy-making. The Americans developed their quantitative data in the thirties while the English published a "White Paper" entitled "An Analysis of the Sources of War Finance and an Estimate of the National Income and Expenditure in 1938 and 1940" during the Second World War. In Norway and the Netherlands the first quantitative data on some kind of National Income appeared in the thirties.

The researchers realized that by itself information on the National Income could not provide all the answers to the problems faced. Consequently, measurement was extended to related totals such as household consumption and fixed capital formation, which were eventually incorporated with the National Income into a system of accounts, describing first a large part and later all of the economy. Since existing statistics covered only part of the economic process and did not always fit into the system even when they were available, new methods of estimation had to be developed for filling in the gaps. And finally there was a new mathematically based application of economic theory and data collection called econometrics, which endeavoured not only to measure but also to explain economic trends. The Economic Intelligence Service of the League of Nations - the forerunner of the United Nations - set up a research project in which Von Haberler and Tinbergen participated. All this research led to a better understanding of economic processes and of economic and social problems. As Robinson, who worked with Keynes at Cambridge, wrote in 1986: "Economics was never the same again". He might have added: and neither was the role of government.

3.2 The system

The National Accounts provide a quantitative description of the economic process in a given country. The word "quantitative" implies the step from economic concepts to statistical measurement. Many detailed definitions and descriptions have been developed in the course of the years. A high degree of detail is essential if statistical tables are to be used for economic and social policies, and even more so if they are to be comparable internationally. This need for detail masks the fact that the system is basically very simple, however. Early researchers took the bookkeeping system used by enterprises as their model. This system shows the assets and liabilities of the enterprise and all its transactions with others. Although balance sheets and profit-and-loss accounts are routinely produced from these records, the directors of the firm can ask for the basic information to be regrouped if this is of relevance for solving the problems they face. Instead of registering the transactions of one unit with all the others, the National Accounts came to register the transactions between all the enterprises, institutions and individuals in a given country. Since there are millions of these "actors" in the economy, a clear overall picture requires a classification of the actors into broad sectors, distinguished by their function in the economy. Next, the transactions between sectors must be classified into groups that serve the description and analysis of the process. These transactions are entered into Accounts, if necessary more than one for each sector. Finally, transactions have to appear twice in the system, since they are always between two sectors. During World War II, work on such schemes was undertaken in several countries quite independently from one another. These early studies focused mainly on the processes of production, income formation and spending. This usually resulted in production Accounts for the sectors Enterprises and Government, an income and consumption Account for Households and for the Government, an Account for fixed capital formation of all sectors together and an Account for transactions with the rest of the world. There were some variations, but these are entirely acceptable if the criterion of international comparability is dropped, as was the case.

Drawing up such lists of transactions was rarely problematical, for there is little freedom of choice involved. The main choices to be made related to fixing the boundaries of the system. The desire to measure transactions and especially to measure the value of these transactions meant that the system had to be restricted, in principle, to those transactions which generate a measurable money flow. Unpaid

domestic work or volunteer work was therefore excluded from the system. Later, Accounts were added for the distribution and redistribution of income and for the financial transactions involved in capital formation. However, the original scope of the system still forms its core and is the key to understanding it.

For the producers in the economy (mostly enterprises, but also other institutions and the government), information about the transactions taking place in their part of the production process can be presented in the form of the following table. Tables 1 and 2 can be seen as the aggregated result of the input-output table which will be discussed below.

The two totals in table 1 must be equal since they involve the same transactions. If this table is constructed for all producers and the results are added, items 1-1 and 2-1 are equal and can be omitted. On the other hand, the emerging picture is not yet quite complete, because the imports of finished products (consumer goods and investment goods) are missing. The total of these imports can be added to item 1-2, while the value of the imported consumer goods and investment goods separately can be added to items 2-2, 2-3, 2-4 and 2-5.

Table 1 - Transactions of goods and services

1.1	Purchases of goods and services from other producers	2.1	Sales of goods and services to other producers
1.2	Purchase of imported intermediary goods and services	2.2	Sales of consumer goods to households
1.3	Compensation of employees	2.3	Sales of consumer goods to the government
1.4	Entrepreneurial income	2.4	Sales of investment goods to enterprises and the government
1.5	Indirect taxes minus subsidies	2.5	Increase in stocks
1.6	Depreciation allowances	2.6	Exports
Total		Total	

The result is a new table (table 2), usually referred to as the "supply and disposition of goods and services". The left-hand side shows the goods and services that are available in the economic process of a nation in a given period. The first four items together form the Gross Domestic Product (GDP), an aggregate of the goods and services produced on the nation's territory. The item Imports stands for the goods and services produced abroad that have entered the national economic process. The right-hand side of table 2 shows the final destination of the available goods and services. Of course, the destination often depends on the nature of the commodities.

Table 2 - Supply and disposition of goods and services

Compensation of employees	Household consumption expenditure
Entrepreneurial income	Government consumption expenditure
Indirect taxes minus subsidies	Gross domestic capital formation
Depreciation allowances	Increase in stocks
Imports of goods and services	Exports of goods and services
Total	Total

Table 2, the end result of a long process of economic research and measurement, is central to the discussions of plans for government policies. The debate on the role of Government and on economic theory continues, of course, and the exact definitions of economic variables depend on the state of economic theory and technology. But table 2 describes an identity. Goods and services have their origin and their destination in the economic process. The system of definition of economic variables must therefore be coordinated. It is, after all, exceedingly difficult to consume a commodity that has not been produced or imported.

Other totals can be derived from the Gross Domestic Product at market prices:

- by deducting indirect taxes minus subsidies: Gross Domestic Product at factor cost;

- by further deducting depreciation allowances: Net Domestic Product at factor cost;

- by adding net factor income from abroad: Net National Product at factor cost, which at current prices equals National Income.

These totals are required for different purposes. Factor costs are the costs of the production factors, otherwise known as Labour and Capital. A study focusing on the gross earnings (or primary income) of production factors, for example, must eliminate the indirect taxes and subsidies that influence the market price. Also, a gross aggregate does not take into account the losses of capital stock resulting from the production process. In addition, in an open economy there is a difference between an income and a production concept, because of possible differences in the price movements of imported goods and services and exported goods and services. This means that the "value" of the income (the package of goods and services that can be bought with a given income) generated by the production process may differ.

All these "product" totals can be readily expressed in constant prices. The starting point for the National Income is the Net National Product at factor cost in constant prices. However, a correction must be made for the fact that some goods farming the Net National Product package which may be imported and exported. If export prices fall relative to import prices (a change in the terms of trade) the package received will be smaller than if the two price trends had been equal. In constant prices, the package that becomes available for the national economy will therefore be smaller than the package produced. The opposite is likewise possible. The corrected total is called real National Income. If this seems somewhat complex, consider the situation for a country producing oil and little else. If it doubles its production in two years and at the same time sees the price of oil halved, its Net Domestic Product at constant prices will double, but its real National Income will remain unchanged, since the imports that it can buy in exchange for its oil will remain at the same level. So tables 1 and 2 can be seen as the consolidated form of a more detailed presentation of the production process, the so-called input-output table. This is a double-entry table in which the information of tables 1 and 2 is given by branch of activity. Table 3 presents a model in which the breakdown of activities is, for practical purposes, limited to four branches.

Table 3 - Model of an input-output table

		Input by branch of activity						Categories of final demand					
		Agriculture, fishing	Manufacturing, mining	Construction	Services	Total columns 1-4	Household consumption expenditure	Government consumption expenditure	Domestic fixed capital formation	Increase in stocks	Exports	Total columns 6-10	Total columns 5 + 11
		1	2	3	4	5	6	7	8	9	10	11	12
Output by branch of activity	1. Agriculture, fishing	848	3079	-	35	3962	745	10	-	3	1179	1937	5899
	2. Manufacturing, mining	1465	9500	389	2142	14496	9375	1015	1899	407	8485	21181	35677
	3. Construction	56	206	384	407	1053	166	256	3597	-	35	4054	5107
	4. Services	240	2218	378	2442	5278	7568	3313	767	75	5376	17099	22377
	5. Total lines 1-4	2609	15003	2151	5026	24789	17854	4594	6263	485	15075	44271	69060
Primary inputs	6. Imports	196	9022	799	1962	11979	1683	319	1856	238	368	4464	16443
	7. Compensation of employees	633	5608	1267	7253	14761	-	-	-	-	-	-	14761
	8. Entrepreneurial income	2248	3369	665	5172	11454	-	-	-	-	-	-	11454
	9. Indirect taxes minus subsidies	-21	1549	177	1389	3094	-	-	-	-	-	-	3094
	10. Depreciation allowances	234	1126	48	1575	2983	-	-	-	-	-	-	2983
	11. Total lines 6-10	3290	20674	2956	17351	44271	1683	319	1856	238	368	4464	48735
Total		5899	35677	5107	22377	69060	19537	4913	8119	723	15443	48735	

Each of the first four rows of table 3 describes the destination of the goods and services produced in the branch of that row. It shows the final categories (consumption, investments and exports) as well as the intermediate destinations. Goods or services that are the output of one branch may serve as the input of another. Furthermore, there are so-called internal deliveries. For example, seeds are both output and input in agriculture.

The first four columns focus on the production processes of the branches, showing how the total production of a given branch is formed. The first four rows of a column show the internal and other intermediate deliveries which, taken together (in row 5), form the total input of domestic origin to the branch. The total of these domestic inputs and the inputs from abroad, or imports, (row 6) is the total input to the branch of activity. The difference between total output (for agriculture, 5 899 in table 3) and total input (2 609 plus 196 also for agriculture) is the gross added value of the branch of activity in question. The aggregate sum of these gross values for all branches of activity (the sum of rows 7,8,9 and 10 in column 12) represents the Gross Domestic Product.

The "supply and disposition of goods and services", as stated in table 2, can be derived directly from the input-output table. The row total of GDP and imports (row 6 of column 12) adds up to the same amount (48 735) as the column totals for the expenditure categories. These are consumption (columns 6 and 7 of row 12), fixed capital formation (column 8, row 12), increase in stocks (column 9, row 12) and exports (column 10, row 12).

For the sake of simplicity, the example of table 3 is limited to four branches of economic activity. In real life, of course, tables can be constructed encompassing hundreds of branches. All these tables are useful for two reasons, one statistical, the other analytical.

Bringing together all the statistical information on output and input of goods and services (and the income generated by their production) in one table means that any entry in the table can be used twice: an entry in a row automatically means an entry in a column and vice versa. This proved a great help during the period when the available statistics covered only a small part of the table and had to be supplemented by estimates. Besides, there are also many other possibilities for calculating missing

figures as residuals, since the table covers a large number of balances in which production plus imports of goods and services are set off against information on uses and exports.

As more statistics became available, some of these uses became superfluous, but the discipline represented by the table is still useful for constructing the current System of National Accounts. The greater the availability of statistical sources, the more accurately macro-economic totals can be calculated. Sometimes statistical results (in the form of averages, for example) may be conflicting, simply because of the nature of statistics. One may also be confronted with non-response, or sample and measurement errors. Under such circumstances, compiling the input-output table is a way to integrate all of the statistical sources.

New statistical uses for the input-output table were found with the emergence of the demand for recent, i.e. quarterly and monthly, figures. Recent statistics are available for many transactions of the system, but by their nature these tend to give less detail and be less accurate than the results of the more comprehensive annual surveys.

The latest input-output tables are therefore often used in combination with recent statistics to obtain estimates of the most important totals of the national accounts. In the Dutch situation input-output tables are used to make extrapolations to the most recent years and quarters. By statistical integration of recent monthly and quarterly data, quarterly national accounts are obtained. Each month a considerable body of statistical information becomes available about Business Cycle developments. The main indicators describing the Business Cycle are published monthly in the Business Cycle Report, which also outlines recent economic developments. Full integration in an input-output table on a monthly basis is virtually impossible, for both conceptual and practical reasons (Algera and Janssen, 1991).

The analytical use of the table should also be mentioned: it permits measurement of the ratios between the primary inputs and the categories of final demand. In this way questions can be answered such as: by how much will imports increase if household consumption expenditure increases by a certain percentage, or what is the direct impact of an increase in capital expenditure on the production level of the various branches of activity. The tables play a similar role in analyzing the

origin of price movements, since an input-output table provides a consistent framework for the relationships between economic actors in the production process. For analytical purposes this means that they can show not only first-order reactions to a given situation (for example a simulation of a specific policy), but also second, third and higher order consequences. A policy of extra house-building, for example, not only means more employment in the construction industry; it also creates more jobs in branches of activity that produce the inputs for the construction industry.

3.3 Use of the accounts

The history of the application of the National Accounts in government policies has not yet been treated, and we now turn to a brief discussion of this issue. The development of the National Accounts in the United States and in Great Britain resulted in part from preparations for World War II. The financing of this war by both countries was subsequently based on these Accounts.

New ideas about the role of government in the economic process (Keynes), idea about modelling the economic process (Tinbergen) and ideas about monitoring the economic process by a systematic, statistical framework were developed and their impact was first felt in international affairs. Although the process of rebuilding the shattered economies of Europe started at once after World War II, it ran into problems after a few years, when existing reserves of foreign currencies became scarce. The United States government then launched the so-called Marshall Plan to provide financial assistance. Countries applying for this aid were required to present their plans for further reconstruction backed up by the newly named National Accounts; annual reports on progress were also to be accompanied by tables.

In order to guarantee uniformity in the presentation of these reports, work on detailed guidelines for tables, concepts and definitions was undertaken by the new Organization for European Economic Co-operation (OEEC). This was the dawning of a new era, and in many European countries the construction of National Accounts became a regular part of the work of government agencies. Again in the field of international relations, the new approach to economic thinking, and perhaps also the success of the Marshall Plan, resulted in plans for providing assistance to poor nations by the rich nations. Here, the international agencies involved found the National

Accounts a useful instrument for assessment and planning, resulting in ever more demand for the accounts.

The international agencies and associations that organized conferences and contributed to expanding the guidelines played an indispensable role in the further development of the system. This began in 1947 with "Measurement of National Income and the Construction of Social Accounts", started by the Committee of Statistical Experts of the League of Nations and finished by the United Nations, which took over these activities. The fact that this was a European-American undertaking again brought the United Nations into the picture: backed up the proceedings of a series of conferences, its Statistical Office published revised guidelines in 1953, followed by revisions and a new issue in 1968. The latest revision appeared in 1993.

A few years after World War II, the International Association for Research in Income and Wealth was founded. This body also made a major contribution to the stream of ideas and suggestions. In all its meetings and in the conferences organized by agencies of the United Nations, the freely exchanged ideas of economists and statisticians greatly helped improve the quality of the work. The new tools found their place in the policies of individual countries. Statistics on the major items of the Accounts are often found in budget papers and in everyday politics and commentaries. Reference to the State of the Economy, as measured in the Accounts, became of central importance. Criticism of their shortcomings is of far later date.

The emergence of similar or parallel economic policies in the countries of the West shows that the introduction of the new way of thinking about economic problems, and on the role of government, took place along similar lines. However, there must have been a definite dividing line between the architects of the system and its builders on the one hand, and politicians on the other. The transfer of ideas across that line was determined primarily by the goals to be achieved. These differed widely: on both sides of the line there were those who wanted the state to remake society as well as those who advocated more modest policies, such as trying to dampen the fluctuations of the Business Cycle or to set up systems of social security for the poor.

At first, the latter choice, with some variation, seemed to have been accepted in the Western world with very little discussion among governments. Later, discussions arose on the potential for applying the System of National Accounts for

other political purposes. Although it was recognized that the possibilities for "remaking" society were limited, the importance of economic and statistical models and other tools to explain economic events remained clear. Nowadays the relationship between economists and statisticians on the one hand and politicians on the other seems almost the reverse of what it was immediately after World War II. Today, analysts must frequently warn politicians not to be too absolute in interpreting model results, which is a common occurrence.

The possibilities of practical application had also to be explored. A factor that helped was the realization that the System of National Accounts gives a coherent picture of economic development in which trends tending to cause disequilibria if left unchecked can be identified. A list of such trends (concerning the balance of payments, the labour market, prices, etc.) can easily be used to draw up an attractive list of government policies. In addition, the system generated quantitative data and in some countries projections for the GDP, and for growth, and politicians soon learned that this kind of growth meant greater opportunities for government programmes, not to speak of the conflicts which are created by growth. This was of later concern.

3.4 Further development of the System of National Accounts (SNA)

The economic and social policies of the Western countries after World War II differed from earlier policies in that they dealt with the economy as a whole. For a long time these policies were quite successful in the countries themselves: incomes reached levels nobody would have dared to expect at the beginning of the period but in the 1980s and 1990s growth slowed down, however. Economic assistance to what came to be called the Third World did not flourish: although there were some rays of hope, in many cases this "development aid" had no lasting results and sometimes progress in material consumption was swept away by population growth.

Although a debate of these problems is largely a debate about questions of policy changes, it also impinges on the definitions in the SNA, specifically the definition of growth as incorporated in the GDP. While these definitions were acceptable in the period in which they were established, gradually it has become clear that they no longer fit the situation that has later emerged.

Stated simply, the problem is that the production of goods and services as measured by the GDP, although it is an important factor in creating welfare, gives an incomplete picture: if the picture is to be completed, other factors must be taken into account, too. Today, the international debate centres around proposals for bringing more elements of welfare into the System. The problem of most of the proposals is quantification. As stated earlier, the boundaries of the System are simple and clear: transactions should be measurable in terms of market prices and/or a real flow of money in the opposite direction of the flow of goods or services. For most of these welfare elements, quantification means that assumptions must be made, in turn implying that (subjective) valuations often start to play a role.

Van Bochove and Van Tuinen therefore made an early proposal for a core, general-purpose system, supplemented with special modules[1] (Van Bochove and Van Tuinen, 1985). The core is a fully fledged, detailed system of National Accounts, with good international comparability. The core system contains the "hard", quantitative, coordinated information on the economic process (production, (re-) distribution of income, income expenditure, savings and gross fixed capital formation and the process of financing). The modules are more analytical and reflect special purposes and specific theoretical views. In this context the term "Satellite Accounting" (SA) has been adopted in the international literature.

In the long discussions on the SNA, some key problems were presented at quite an early date by the Scandinavians, who stated that the system did not take due account of the loss of their forests by extensive harvesting. At the time, although the idea was recognized as correct, it was argued that the growing of forests was not included either, that inclusion in the system would be very difficult and that the problem was not important anyway. Elements considered eligible for incorporation in a more satisfactory measure of growth included: war and the threat of war, crime and corruption, the environment, depletion of natural resources, voluntary work, household work, inequality of the distribution of income and wealth, and unemployment. How these could be successfully integrated remained unclear, however, and resistance to such a change was moreover fierce.

[1] The ideas were not completely new; some of the main ideas had been set out in an earlier paper; see Van Eck, Gorter and Van Tuinen (1983).

It becomes increasingly that the Accounts provide insufficient information on environmental resources. As the unpleasant effects of growth in this area have multiplied, quantitative information on many kinds of pollution have been developed, as have government policies aimed at stemming the tide. The idea of an alternative estimate of the GDP that would account for these negative effects has been around for some time. For this purpose the so-called National Accounting Matrix (NAM) was developed in the Netherlands, including Environmental Accounts (NAMEA)[2]. In the NAMEA environmental indicators are put on a par with the major aggregates in the National Accounts, such as the National Income. Extra rows and columns are added in the National Accounts Matrix for information on emissions of toxic substances, supply and reuse of waste, production and use of raw materials and energy, and, in principle, the use of land, water and air. The environmental indicators reflect the goals of the environmental policies of the government. The NAMEA is suitable for use as a database for modelling the interaction between the national economy and the environment. A further step will be the calculation of environmental losses, based on the NAMEA. This is the subject of a project called Sustainable National Income (SNI), which is one of the major challenging messages of this paper.

Just as the National Accounts were useful in a period in which politicians were developing their policies against the backdrop of the entire economy, environmental policies might become more effective as part of overall policy if the improvement or deterioration of the environment in a given period were to be included in the System of National Accounts. The inclusion of environmental changes (value changes of natural assets) could be reflected in an alternative level of investment and an alternative GDP. Such a move is essential today, as the scarcity/poverty of environmental and natural resources has started to dominate the overall economic process a trend that is destabilising the world economy in a way never before predicted. It is time for a change and this even more true for Africa which has to start recognizing that natural resources (land, soil, forest, etc.) are not just gifts to be used without accounting for, that natural resources must be considered as capital to be amortized, and to be maintained at least constant, if not, to be increased and improved, to be accounted for in the National Accounting System.

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[2] In a pilot study the NAMEA is presented with concrete figures for 1989; see De Haan, Keuning and Bosch (1993).

4. Agricultural and Natural Eco-systems Use and Sustainability

In this part, the environmental issues arising in various agricultural and natural resource eco-systems are examined. These include pastoral systems, extractive systems (e.g. forestry), and exploitive systems (e.g. irrigated agriculture and marginal cropland). In each case the systems are seen as having a range of possible equilibria, with the use of natural resources, after accounting for them and allowing for their regeneration, being consistent with the capacity of the systems to provide for and support certain animal and human populations. The shift away from such an equilibrium for social and economic reasons, or for reasons related to natural stresses and shocks, can result in unsustainable development. Whether the systems then returns to a new sustainable equilibrium or not will depend on how it responds internally to the disequilibria, as well as what external pressure are brought to bear on the system. The latter include the economic and social policies outlined above and described in greater detail in later parts.

4.1 Pastoral Systems

According to Sanford, there are some 15-24 million people living in the African drylands in economies that are based on the holding of livestock. Most of these are pastoralists, with livestock fed from natural sources rather than cultivated ones. Almost all pastoralists are in fact agro-pastoralists, with even transhumants growing some crops. The system has evolved over centuries into an equilibrium that is efficient in providing a way of storing sporadic grass and rain in useable form over the year and is adaptable in coping with drought. However, sustained drought and reduced land availability has resulted in a shift from this equilibrium and into a phase that represents, at least temporarily, unsustainable land use (Sanford, 1983).

The reasons for this shift are complex and not fully understood. There are essentially three models attempting to explain the interactions between pastoralists and their environment, particularly the effect of an increase in the stock of animals beyond the maximum sustainable capacity of the system. There is an equilibrium model, based on the assumption that carrying capacity is fixed and that the stock of animals will return to a maximum sustainable level given the land and resources available; a degradation model, which assumes that, once there is a shock to the

system the carrying capacity deteriorates irreversibly; and a resilience model, which assumes that the stock and carrying capacity interact with each other, so that a reduction in the latter induces a reduction in the former until a new equilibrium is reached (Barrett, 1989).

As Barrett points out, the equilibrium model is clearly unsatisfactory, as it does not allow for a reduction in carrying capacity, which is a critical feature of the problem facing pastoral systems. The degradation model is also partly unsatisfactory, as systems do show some ability to recover from shocks and stresses. Nevertheless there are some indications that endogenous forces may move systems away from equilibrium when subject to shock. For example, in the presence of drought and natural calamities it may be rational for individuals to increase holdings to ensure a given survival rate (Barbier, 1988). Such perverse pressures are counteracted by others that move the system closer to equilibrium and a recent survey of models in this area indicates that the 'resiliency model accords better with empirical situation' (Horowitz, Little). This depends on observing that, as prices fall and inputs prices of grains rise, so destocking in times of drought will take place. But, as was pointed out above, there are countervailing pressures and the process of destocking may take so long that there is a serious danger of overgrazing in the interim.

The African experience indicates that rangelands have declined in size as a result of more land being taken up for subsistence and cash crops and mechanized agriculture. However, there is less agreement as to whether what is left is being degraded and what in fact its carrying capacity is (6). As better techniques are employed the improved information will help resolve not only the disputes about what the situation actually is, but will play a crucial role in devising better and more effective policies in this area. At the same time there are certain local areas where degradation of land has clearly been witnessed. For example, in Botswana bush encroachment - the loss of palatable perennial species in favour of less palatable ones and of woody biomass has been observed in the rangelands, particularly in centres of cattle concentration and cattle and small stock holdings have risen sharply in the 1980s. One of the common causes of local desertification has been the presence of wells that provide too much water, which results in overcrowding and damage to the environment (Timberlake, 1985).

In the light of great scientific uncertainty, policies have to be designed to ensure sustainable use of these fragile resources. Clearly such policies have to take account of that uncertainty. One common complaint has been that government pricing policies actually encourage overstocking, through subsidising inputs such as veterinary services and slaughter facilities; and of providing tax incentives to hold livestock. In fact the literature on pastoral systems is generally critical of most interventions in this area - commercial ranching, provision of wells and attempts to settle nomadic groups. The crux of the criticisms is that they are based on an inadequate understanding of the systems themselves, do not take account of feedback responses, do not pay enough attention to local implementation capabilities, and are not always motivated by considerations of sustainable development. Some of these issues are taken up again in Section III.

4.2 Forestry

There is widespread concern on the rate of deforestation in tropical and sub-tropical forest systems particularly in Africa. On the basis of approximate data, the world was losing about 12.4 million hectares a year of tropical forests in the 1980s (7). This was from a stock of 1.16 billion hectares. Concern has been expressed because of the range of services that forests perform, many of which are not replaceable. Included in this list are:

- homelands for many indigenous people, some practicing shifting cultivation
- habitant for a range of species, which in turn have a range of values (biodiversity)
- supply of timber
- supply of forest products
- prevention of soil erosion or limitation of the rates of erosion
- supply of recreational facilities (e.g. eco-tourism)

- protection of watersheds through water retention and water cleaning

- provision of local microclimatic functions

- supply of carbon sinks in terms of global warming effects (8).

There are strong reasons to believe that this rate of deforestation and, equally importantly, the loss of forest cover in many parts of the world represents an unsustainable development process. It represents an inefficient use of resources, acts against the interest of weak and poor sections of societies and destroys the resilience of the eco-systems of which they are a part. The consequences of deforestation to the agricultural sector are at two levels. At the local level, as trees and other forest products become scarce, rural communities feel the effects first. Notable there is the fact that other forest products such as fodder and forage are at least as important as fuelwood in most cases. As these communities feel the scarcity/poverty, they tend to forage further a field and use roots and crop residues, thus adding to the soil's instability and reducing its fertility. There is also evidence to suggest that reduced forest cover is associated with increased runoff and accelerated soil erosion which compound the difficulties of these communities. Over a larger geographical region, deforestation also has important consequences for watershed management (see irrigated agriculture) and causes increases in intensity of flooding.

It is well established in Africa that the purposes for which forests are cleared are mainly agricultural colonisation (i.e. slash and burn agriculture, large scale agriculture and ranching); and unsustainable commercial logging. By contrast tropical moist forests suffer little from fuelwood use of forests resources, although that is a problem in arid areas. The underlying factors that drive these uses are more complex but a number of authors have pointed out that misdirected government policies are as much responsible as any other factors. For example some authors have identified the role of tax shelters and subsidies in encouraging clearance of African forests and of the Brazilian Amazon and Gillis has identified the role of market distortions in deforestation in Asia (9). In addition to distorted government tax and pricing policies, there is an inadequate value attached to conserving forest resources or to reafforestation programmes when making investment decisions such as the building of roads or the inundation of land for reservoirs. Finally there are inappropriate legal

and tenurial arrangements to protect the rights and interests of indigenous users and to enhance the sustainable use of forest resources.

Hence a number of policy changes are required in this area, ranging from a proper valuation of the resource to changes in tenure and property rights to exploit forest resources. However, the changes in policies in this area are complex and it would be a mistake if this short description gave an impression to the contrary. Valuing the non-market functions of forests is possible but requires considerable data and there are great uncertainties surrounding the estimates. The functions described in 4.1 above vary greatly on how the deforestation is carried out and where it is carried out. There are few general propositions that hold true. The policy reforms are also surrounded with difficulties and local issues that need to be understood if they are to be successful. These questions will be raised again later on when policies for sustainable development are analyzed.

4.3 Irrigated agriculture

As pointed out by Svendsen, irrigated systems display certain key features that characterise the problems of sustainability in agricultural systems (Svendsen (188). The first is the discontinuity of response. As the level of the watertable moves upwards, there is little impact up to a depth of 3 meters. Between 3 and 2 meters it begins to enter the crop root zone, and above two meters it will rise to the surface. If the sub-surface water is saline, production is immediately affected and the land can be rendered unproductive in a few seasons. Thus there is a discontinuity in the level of the watertable that can be tolerated if the land is to be used sustainably. The second feature is the interlocking impacts of the use of natural resources. Such interlocking is sometimes referred to as externalities and relates to the fact that activities in one area, or at one point in time, have impacts on other outputs and resources in other areas and at other points in time. With irrigated agriculture there are many such externalities, one of the most prominent being the effect of the over-exploitation of a watershed above an irrigation reservoir on the reservoir itself, through increased siltation (10). The presence of externalities can also lead to an unsustainable use of resources in the sense that they are not being used in the most effective manner to achieve the goals of supplying certain outputs at the minimum social cost.

It should be noted that in Africa, only Egypt, Sudan and Madagascar have meaningful irrigated totalling 90 per cent of irrigated areas in Africa (10 millions ha presently). Sustainable irrigation system must become part of African Sustainable Agricultural Development.

Svendsen identifies three broad areas where sustainability in irrigation faces problems. These are: (a) the scope for maintaining agriculture productivity in the face of constraints on the level of new system construction and declines in water available to existing systems; (b) the sustainability of the functioning of the irrigated systems actually in operation; and (c) the failure to take account of the external effects between interrelated systems such as agroforestry and livestock. The first of these arises because, whereas most of the growth in irrigated agriculture to date has come from an expansion in areas irrigated, in the future this is not likely to be the case. In Asia most accessible resources have already been exploited and in Africa the economic costs of new developments are often considered to be too high. In view of these factors, policies that will be required to achieve sustainable use of irrigated agriculture will include a combination of: (a) physical improvements to existing systems, (b) changes in management structures and practices; and (c) economic incentives for a more rational use of the resources.

Several studies have highlighted the problems with the operation of existing irrigation schemes in African countries. These include shortfalls in areas served, lower than expected productivity, allocational disparities, non participatory nature of the schemes, large cost burdens on central and local governments, and rapid deterioration and frequent system rehabilitation. The challenge on the policy front is to design the choice of reforms and instruments to eliminate these occurrences. The Sustainable Agricultural and Environmental Rehabilitation and Development Programme for Tigray Region (Ethiopia) has been designed to face this challenge.

It is well known that irrigation systems suffer from several negative externalities, including siltation of reservoirs, salinity and waterlogging. The latter two pose a serious threat to the sustainability of many irrigation systems, world-wide. In some cases salinity and waterlogging can only be addressed by undertaking extensive surface or tile drainage investment programmes, but in others, and also as a complement to the such investments, several policy measures could also be of help. These should be designed to reduce over-irrigation, which is an important cause of

waterlogging and salinity. They should also look at various farm-level and other private sector incentives for water table control.

4.4 Marginal lands

Marginal lands are characterised not only by their low quality and productivity but also by their greater insecurity. The implication of the latter is that changes in farming systems on such land - such as monocropping or productivity increasing activities - which are not adequately adapted to it may render them even more vulnerable. Such lands include most of Sub-Saharan Africa, and also the semi-arid and arid lands, uplands, swamp lands and converted forest lands of Asia and Latin America (11).

There are two common misconceptions regarding marginal lands. First is the view that marginal lands are populated and farmed by poor people. As Schuh points out, some of the richest farmers in Latin America are large cattle ranchers with large holdings of marginal land (Schuh, 1988). Nevertheless, in Africa, many marginal lands are farmed by low income households, often forced into the use of such land because of population pressures and forced landlessness. In each case policies for sustainable use will vary. The second misconception is that such land has and always will have limited production potential. While it is true that it will not have the productivity of higher quality land, there is considerable evidence to suggest that, with appropriate techniques and economic incentives it can be successfully farmed and can make an important contribution to Sustainable Agricultural Development. As Conway and Barbier demonstrate there are several examples of projects that have improved yields on a sustainable basis in the most difficult of agricultural conditions (Conway and Barbier 1990). In many resource poor countries in Africa, such policies are not a matter of choice; they are essential if the country is to survive let alone develop sustainably.

What are the appropriate policies that will result in sustainable use of such lands? A number of options are possible. For highly erodible soils, a shift out of annual cropping into perennial tree crops and livestock based systems might be considered. Another would be to relieve the pressure on the land to support a given population by increasing off-farm income and employment opportunities. Third, there

is considerable scope for employing farming technology that is properly adapted to such systems. This would include returning to intercropping to replace monocrops in certain cases, and the development of varieties that perform better with low external inputs, the supply of which is uncertain and often unaffordable by such farmers. Fourth, where there is uncertainty of title or access to sufficient land, legal reforms could be instituted. As a combined strategy Norse argues in terms of two phased approach - a short term one concentrating on applying low-risk, low external input processes and a longer term one of increasing off-farm income and improving yields in favoured areas, which can act as a source of migration for the pressured marginal areas (Norse, 1988).

Clearly the policies required will vary according to circumstances, and so will the economic and social instruments by which such policies would be implemented. These may include fiscal inducements to shift production from one crop to another or direct extension and support services. What is often forgotten however, is the extent to which the pattern of land use in marginal areas is also influenced by broader macroeconomic policies. A common example is the high rate of export taxes on perennial crops such as coffee that act to reduce the production of such crops which could be cultivated on a more sustainable basis on marginal lands. There are many other examples where government pricing policies, instead of aid to the sustainable use of marginal lands, actually operate to move use away from sustainability.

Section III

STATE OF THE ENVIRONMENT AND VALUATION OF ENVIRONMENTAL IMPACTS FOR SUSTAINABLE AGRICULTURAL DEVELOPMENT

"As we edge towards the end of the 20th century, we find resources to rehabilitate our resource base depleted. What little we can muster should, therefore, focus on areas of over-riding concern. None is more compelling, I submit, than to have local knowledge and the cutting edge of science to rehabilitate disintegrating African eco-systems. Over the ruins, we must build sustainable agriculture. There should be no illusions about the difficulties these undertakings impose. Rehabilitating damaged aquifers, forests, lands, or reversing soil degradation make fighting insurgency seem like child's play."

From the author's personal Notes

1. The State of the Environment

It takes no stretch of the imagination to see that the human species is now an agent of change of geologic proportions. We literally move mountains to mine the earth's minerals, redirect rivers to build cities in the desert, torch forests to make way for crops and cattle, and alter the chemistry of the atmosphere in disposing of our wastes. At humanity's hand, the earth is undergoing a profound transformation - one with consequences difficult to grasp.

It may be the ultimate irony that in our efforts to make the earth yield more for ourselves, we are diminishing its ability to sustain life of all kinds, humans included. Signs of environmental constraints are now pervasive. Cropland is scarcely expanding any more, and a good portion of existing agricultural land is losing fertility. Grasslands have been overgrazed and fisheries over harvested, limiting the amount of additional food from these sources. Water bodies have suffered extensive depletion and pollution, severely restricting future food production and urban expansion. The stability of the atmosphere has been disrupted, with heat-trapping greenhouse gases

increasing and the life-protecting ozone layer diminishing. And natural forests - which help stabilize the climate, moderate water supplies, and harbour a majority of the planet's terrestrial biodiversity - continue to recede.

These trends are not altogether new. Human societies have been altering the earth since they began. But the pace and scale of degradation over the last several decades is historically new. Since 1950, three trends have contributed most directly to the excessive pressures on the earth's natural systems: the doubling of world population, a 250 per cent increase of per capita economic output, and the widening gap in the distribution of income. A search for the root causes of environmental decline reveals that the environmental impact of the human population, now 5.6 billion, has been vastly multiplied by economic and social systems that strongly favour growth of production and ever-rising consumption over equity and poverty alleviation; and that do not discriminate between means of production that are environmentally sound and those that are not.

The central conundrum of sustainable development is now all too apparent: population and economies grow exponentially, but the natural resources that support them do not. In recent years, the global problems of ozone depletion and greenhouse warming have underscored the danger of overstepping the earth's ability to absorb our waste products. Less well recognized, however, are the consequences of running down the natural capital of essential renewable resources - especially land, water, and forests - and how far along that course we may already be. On the contrary, it is often advocated to switch from mineral to biological resources. We will illustrate that this is not a viable strategy. In fact, the limits of emission sinks, biological and mineral resources are mutually linked. Stretching one of them usually results in shrinking the others.

1.1 The Resource base

Biologists often apply the concept of "carrying capacity" to questions of population pressures on an environment. Carrying capacity is the largest number of any given species that a habitat can support indefinitely. When that maximum sustainable population level is surpassed, the resource base begins to decline - and sometime thereafter, so does the population.

The outer limit of the planet's carrying capacity is determined by the total amount of solar energy converted into biochemical energy through plant photosynthesis minus the energy those plants use for their own life processes. This is called the earth's Net Primary Productivity (NPP), and it is the basic food source for all life on earth.

Prior to human impacts, the earth's forests, grasslands, and other land based ecosystems had the potential to produce a net total of some 150 billion tons of organic matter per year. Biologist Vitousek and his colleagues estimate, however, that humans have destroyed outright about 12 per cent of the potential terrestrial NPP and now directly use or co-opt an additional 27 per cent (Vitousek, 1986).

It may be tempting to infer that, at 40 percent of land based NPP, we are still comfortably below the ultimate limit. But this is not the case. We have appropriated the 40 per cent that was easiest to acquire. Although it should be taken into account that the highest increases of population occur in areas where the per capita resource consumption is relatively low, deducting it from GNP to arrive at Net National Product (NNP) theoretically doubling of NNP use would happen in just 60 years if the human share rose in tandem with population growth. And if average resource consumption per person continues to increase, that doubling would occur much sooner.

Perhaps more important, human survival hinges on a host of environmental services provided by natural systems - from forests' regulation of the hydrological cycle to wetlands' filtering of pollutants. As we destroy, alter, or appropriate more of these natural systems for ourselves, these environmental services are compromised. At some point, the likely result is a chain reaction of environmental decline - widespread flooding and erosion brought on by deforestation, for example, or worsened drought and crop losses from desertification, or pervasive aquatic pollution and fisheries losses from wetlands destruction. The simultaneous unfolding of severa such scenarios causes unprecedented human hardship, famine, and disease. Precisely when vital thresholds will again be crossed, no one can say. In any case it should be noted that by appropriating the most easily accessible land we have concentrated the stress on particular types of ecosystems, thus the risk of eliminating vital systems is higher than suggested by the figures of appropriation of NNP. As Vitousek and his colleagues note, those "*who believe that limits to growth are so distant as to be of no consequence for today's decision makers appear unaware of*

these biological realities" (Vitousek, 1986). In many parts of the globe, these catastrophes have already occurred - in ancient history as well as in the recent past - but strangely-enough-learning from its is quite limited.

What do we do when we have claimed nearly all that we can from the earth, yet our population and demands are still growing? This is precisely the predicament we now face.

Cropland: Cropland area (Ca) worldwide expanded by just 2 per cent between 1980 and 1990, to a total of ca. 1.44 billion hectares. This means that gains in the global food harvest came almost entirely from raising yields on existing cropland. Most of the remaining area that could be used to grow crops is in Africa and Latin America; very little is in Asia. The most sizable near-term additions to the cropland base are likely to be a portion of the 76 million hectares of savanna grasslands in South America that are already accessible and potentially cultivable, as well as some portion of African rangeland and forest. These conversions, of course, may come at a high environmental price, and will push our 40-percent share of NPP even higher (12).

Moreover, a portion of any cropland gains that do occur will be offset by losses. As economies of developing countries diversify and as cities expand to accommodate population growth and migration, land is rapidly being lost to industrial development, housing, road construction, and the like. Canadian geographer Vaclav Smil estimates, for instance, that between 1957 and 1990, China's arable land diminished by at least 35 million hectares - an area equal to all the cropland in France, Germany, Denmark, and the Netherlands combined. At China's 1990 average grain yield and consumption levels, that amount of cropland could have supported some 450 million people, about 40 per cent of its population (Smil 1992).

In addition, much of the land we continue to farm is losing its inherent productivity because of unsound agricultural practices and overuse. The Global Assessment of Soil Degradation, a three-year study involving some 250 scientists, found that more than 550 million hectares are losing topsoil or undergoing other forms of degradation as a direct result of poor agricultural methods (Oldeman et al., 1991).

Another cause of productivity loss is environmental emissions. A survey of studies on air pollution damages to agriculture and forestry showed national estimates ranging from 0.2 to 7 billion US$ (Strand and Wenstöp). Global warning poses a serious treat to bioproductivity, because ecosystems cannot adapt at a sufficiently high rate to changing climatic conditions.

On balance, unless crop prices rise, it appears unlikely that the net cropland area will expand much more quickly over the next two decades than it did between 1980 and 1990. Assuming a net expansion of 5 per cent, which may be optimistic, the projected 33 percent increase in world population by 2010 would result in a decline of the amount of cropland per person of 21 per cent (see table 4).

Table 4 - Population size and availability of renewable resources, circa 1990, with projections for 2010[*]

	1990	2010	Total change	Per capita change
	(million)		(percent)	
Population	5,290	7,030	+ 33	-
Fish catch (tons)[**]	85	102	+ 20	- 10
Irrigated lands (hectares)	237	277	+ 17	- 12
Cropland (hectares)	1,444	1,516	+ 5	- 21
Rangeland and pasture (hectares)	3,402	3,540	+ 4	- 22
Forests (hectares)[***]	3,413	3,165	- 7	- 30

[*] Sources: Population figures from U.S. Bureau of the Census, Department of Commerce, *International Data base*, unpublished printout, November 2, 1993; 1990 irrigated land, cropland, and rangeland from UN Food and Agriculture Organization (FAO) (1992), *Production Yearbook 1991*, Rome; fisn catch from M. Perotti, chief, Statistics Branch, Fisheries Department, FAO, Rome, private communication, November 3, 1993; forests from FAO (1992 and 1993), *Forest Resources Assessment 1990*, Rome, and other sources documented in note 15. For explanation of projections, see text.

[**] Wild catch from fresh and marine waters, excludes aquaculture.

[***] Includes plantations; excludes woodlands and shrublands.

Pasture and rangeland: cover some 3.4 billion hectares of land, more than twice the area in crops. The cattle, sheep, goats, buffalo, and camels that graze them convert grass, which humans cannot digest, into meat and milk, which they can. The global ruminant livestock herd, which numbers about 3.3 billion, thus adds a source of food for people that does not subtract from the grain supply, in contrast to the production of pigs, chickens, and cattle raised in feedlots.[3]

Much of the world's rangeland is already heavily overgrazed and cannot continue to support the livestock herds and management practices that exist today. According to the Global Assessment of Soil Degradation, overgrazing has degraded some 680 million hectares since mid-century. This suggests that 20 per cent of the world's pasture and range is losing productivity and will continue to do so unless herd sizes are reduced or more sustainable livestock practices are put in place.[4]

This degradation imposes severe economic costs. In Africa, for example, the annual loss of rangeland productivity is estimated at $7 billion, more than the GNP of Ethiopia and Uganda combined. Asia has by far the largest economic losses from land degradation of any region - an estimated $21 billion per year from waterlogging and salinization of irrigated cropland, erosion of rainfed land, and overgrazing of rangeland (Dregne et al., 1991).

During the eighties, the total range area increased slightly, in part because land deforested or taken out of crops often reverted to some form of grass. If similar trends persist over the next two decades, by 2010 the total area of rangeland and pasture will have increased 4 per cent, but it will have dropped 22 per cent in per capita terms. In Africa and Asia, which together contain nearly half the world's rangelands and where many traditional cultures depend heavily on livestock, even larger per capita declines will significantly weaken food economies.

Fisheries: another natural biological system that humans depend on - add calories, protein, and diversity to human diets. The annual fish catch from all sources, including aquaculture, totalled 97 million tons in 1990, about 5 per cent of the protein

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[3] FAO, op. cit. note 3.

[4] Oldeman et al., op.cit. note 5.

humans consume. Fish account for a good portion of the calories consumed overall in many costal regions and island nations (13).

The world fish catch has climbed rapidly in recent decades, expanding nearly fivefold since 1950. But it peaked at just above 100 million tons in 1989. Although catches from both inland fisheries and aquaculture (fish farming) have been rising steadily, they have not offset the decline in the much larger wild marine catch, which fell from a historic peak of 82 million tons in 1989 to 77 million in 1991, a drop of 6 per cent (14).

With the advent of mechanized hauling gear, bigger nets, electronic fish detection aids, and other technologies, almost all marine fisheries have suffered from extensive overexploitation. Under current practices, considerable additional growth in the global fish catch overall looks highly unlikely. Indeed, the UN Food and Agriculture Organization (FAO) now estimates that all 17 of the world's major fishing areas have either reached or exceeded their natural limits, and that 9 are in serious decline (15).

FAO scientists believe that better fisheries management might allow the wild marine catch to increase by some 20 per cent. If this could be achieved, and if the freshwater catch increased proportionately, the total wild catch would rise to 102 million tons; by 2010, this would nonetheless represent a 10-percent drop in per capita terms (16).

Fresh water: may be even more essential than cropland, rangeland, and fisheries; without water, after all, nothing can live. Signs of water scarcity are now pervasive. Today, 26 countries have insufficient renewable water supplies within their own territories to meet the needs of a moderately developed society at their current population size - and population are growing fastest in some of the most water-short countries, including many in Africa and the Middle East. Rivers, lakes, and underground aquifers show widespread signs of degradation and depletion, even as human demand rise inexorably (Postel, 1992).

Water constraints are slowing food production, and if present practices and technologies are continued, those restrictions will only become more severe. Agricultural lands that receive irrigation water play a disproportionate role in meeting

the world's food needs: the 237 million hectares of irrigated land account for only 16 per cent of total cropland but more than a third of the global harvest. For most of human history, irrigated area expanded faster than population did, which helped food production per person to increase steadily. In 1978, however, per capita irrigated land peaked, and it has fallen nearly 6 per cent since then.[5]

Forests and woodlands: the last key component of the biological resource base, contribute a host of important commodities to the global economy - logs and lumber of constructing homes and furniture, fibber for making paper, and, in poor countries, fuelwood for heating and cooking. More important even than these benefits, however, are the ecological services forests perform - from conserving soils and moderating water cycles to storing carbon, protecting air quality, and harbouring millions of plant and animal species.

Today forests cover 24 per cent less area than in 1700 - 3.4 billion hectares compared with an estimated 4.5 billion about 300 years ago. Most of that area was cleared for crop cultivation, but cattle ranching, timber and fuelwood harvesting, and the growth of cities, suburbs, and highways all claimed a share as well. Recent assessments suggest that the world's forests declined by about 130 million hectares between 1980 and 1990, and area larger than Peru. And as with the other resources, much of the forest resource base is declining in health and quality as well - in part from air pollution and acid rain (17).

1.2 Redirecting technology

Like trade, technology has often proven to be a double-edged sword. By allowing for tremendous gains in resource efficiency and productivity, technological advances can help us get more out of each hectares of land, ton of wood, or cubic meter of water.

But for example, the irrigation, agricultural chemicals, and high-yielding crop varieties that made the Green Revolution possible also depleted and contaminated water supplies, poisoned wildlife and people, and encouraged monoculture cropping

[5] *Ibid.*

that reduced agricultural diversity. Huge driftnets boosted fish harvests but contributed to overfishing and the depletion of stocks.

As a society, we have failed to discriminate between technologies that meet our needs in a sustainable way and those that do so by harming the earth. We have let the market largely dictate which technologies move forward, without correcting for its failure to take proper account of environmental damages.

A significant portion of the world's current food output is produced by using land and water unsustainably - in large part because farmers do not pay the full costs of soil erosion, excessive water use, and contamination of the environment by pesticides. For instance, in parts of India's Punjab, the nation's breadbasket, the high-yielding rice paddy-wheat rotation that is common requires heavy doses of agricultural chemical and substantial amounts of irrigation water. A 1993 study by researchers from the University of Delhi and the World Resources Institute in Washington D.C., found that in one Punjab district, Ludhiana, groundwater pumping exceeds recharge by one third and water tables are dropping nearly 1 meter per year (Malik and Faeth, 1993).

Indeed, in many regions - including much of Africa, northern China, southern India (as well as the Punjab), Mexico, the Western United States, and parts of the Middle East - water may be much more of a constraint to future food production than land, crop yield potential, or most other factors. Developing and distributing technologies and practices that improve water management is critical to sustaining the food production capability we now have, much less increasing it for the future. Such technologies are available as examples amplified:

Water-short Israel is a front-runner in making its agricultural economy more water-efficient. Its current agricultural output could probably not have been achieved without steady advances in water management - including highly efficient drip irrigation, automated systems that apply water only when crops need it, and the setting of water allocations based on predetermined optimum water applications for each crop. The nation's success is notable: between 1951 and 1990, Israeli farmers reduced the amount of water applied to each hectare of cropland by 36 percent (Tuijl, 1993).

By applying basic technological measures we will be able to satisfy the global demand for fresh water for only another 20 to 30 years. Locally severe problems will occur much earlier (Meadows, Meadows, 1991).

With respect to environmental efficiency in bioproduction large gains can still be obtained. For instance in the Netherlands, over the period 1984-1993, the use of pesticides, which on a weight per hectare basis is the highest in the world, has been reduced by 40 per cent. By also considering specific ecotoxicity CLM, a Dutch institute specialising on the environmental impact of agricultural, estimates that a reducing of 90 to 95 per cent of the environmental load can be obtained.

Paralleling the need for sustainable gains in land and water productivity is the need for improvements in the efficiency of wood use and reductions in wood and paper waste in order to reduce pressures on forests and woodlands. A beneficial timber technology is no longer one that improves logging efficiency - the number of trees cut per hour - but rather one that makes each log harvested go further. Raising the efficiency of forest product manufacturing in the United States, the world's largest wood consumer, roughly to Japanese levels would reduce US timber needs by about a fourth, for instance. Together, available methods of reducing waste, increasing manufacturing efficiency, and recycling more paper could cut US wood consumption in half; a serious effort to produce new wood-saving techniques would reduce it even more (Postel and Ryan, 1991).

Technological development is limited not only by physical restrictions but also by social barriers. Apart from an inherent natural resistance to change economical considerations and institutional arrangements are crucial. For instance, Dutch flower producers argue they are forced to use enormous amounts of pesticides, because some importing countries set ridiculous standards on the occurrence of pest organisms. In this respect, again Japan is notorious in setting "*zero fault tolerance levels*". Since the producer does not know in advance to which country his products will be sold he has to adjust to the strictest standards.

1.3 The Double-edge of trade

Imports of biologically based commodities like food and timber are, indirectly, imports of land, water, nutrients, and the other components of ecological capital needed to produce them. Many countries would not be able to support anything like their current population and consumption levels were it not for trade.

In principle, there is nothing inherently unsustainable about one nation relying on another's ecological surplus. The problem, however, is the widespread perception that all countries can exceed their carrying capacities and grow economically by expanding manufactured and industrial goods at the expense of natural capital - paving over agricultural land to build factories, for example, or clear-cutting forest to build new homes. But all countries cannot continue to do this indefinitely. Globally the ecological books must balance.

Many economists see no cause for worry, believing that the market will take care of any needed adjustments. As cropland, forests, and water grow scarce, all that is necessary, they say, is for prices to rise; the added incentives to conserve, use resources more productively, alter consumption patterns, and develop new technologies will keep output rising with demand. But once paved over for a highway or housing complex, or eroded, cropland is unlikely to be brought back into production - no matter how severe food shortages may become. Moreover, no market or price mechanism exists for assuring that an adequate resource base is maintained to meet needs that the market place ignores or heavily discounts - including those of vital ecosysterns, other species, the poor, or the next generation.

1.4 Lightening the load

Ship captains pay serious care to a marking on their vessels called the Plimsoll line. If the water level rises above the Plimsoll line, the boat is too heavy and is in danger of sinking. When that happens, rearranging items on the ship will not help

much. The problem is the total weight, which has surpassed the carrying capacity of the ship.[6]

Herman Daly sometimes uses this analogy to underscore that the scale of human activity can reach a level that the earth's natural systems can no longer support. The ecological equivalent of the Plimsoll line may be the maximum share of the earth's biological resource base that humans can appropriate before a rapid and cascading deterioration in the planet's life-support systems is set in motion. Given the degree of resource'destruction already evident, we may be close to this critical mark. The challenge, then, is to lighten our burden on the planet before, metaphorically speaking, the ship sinks.

The days of the frontier economy - in which abundant resources were available to propel production growth and living standards - are clearly over. We have entered an era in which global prosperity increasingly depends on using resources more efficiently, distributing them more equitably, and reducing consumption levels overall. And of course, the problem of food production capacity does not stand alone. On the one hand we have some potential threats which might develop equally, or even more, disastrous in the same time frame, i.e. global warming. On the other hand, in large parts of the world the traditional problems of sanitation and safe water supply already create such a burden that we can consider these problems as being over the threshold of sustainability. Unless we accelerate this transition, we risk exceeding the plant's carrying capacity to such a degree that a future of economic and social decline will be impossible to avoid.

2. Valuation of the Environment Impacts and Agricultural Development

In Section II, we have looked at the issue of sustainable development in the context of four areas related to agriculture: pastoral systems, forest systems, irrigated land systems and marginal land systems. One conclusion is that such systems have substantial interlinkages with development or changes in one area is likely to have

[6] This analogy is borrowed from Herman Daly, senior economist, World Bank. See Daly, Herman E., 1992: "Allocation, Distribution, and Scale: Towards an Economics that is Efficient, Just, and Sustainable", *Ecological Economics*, December 1992.

repercussions in many others. Hence policies for sustainable agriculture have to be aware of such interlinkages - or externalities as they are sometimes called. A second conclusion is that the actions that exacerbate unsustainable use are often government policies that are either misconceived, or carried out for other reasons. This is what Panayotou refers to as policy failure (Panayotou, 1990). Correcting these would take one a long way towards sustainable use. However, such corrections are not enough and if further progress is to be made a range of reforms are necessary. These include devising better rules for the allocation of investment resources, better methods for evaluating environmental impacts in the context of defining regulation on land use, and better fiscal incentives for farmers to take sustainable actions. They also include reforms to the legal and social framework. This is the third conclusion. Finally although one can speak usefully in generalities, the actual policies are instruments will vary from one situation to another. Recognising and understanding local conditions and socio-economic circumstances is critical to the success of any policy reforms.

In the schema in figure 2, a central role is ascribed to the valuation of environmental impacts, both positive and negative, if sustainable agricultural development is to take place. This sub-section reviews the techniques available and assesses their suitability for measuring environmental costs and benefits in money terms in the context of agricultural problems in developing countries. The emphasis here is on monetary valuation. The use of physical indicators and non-monetary measures is raised in Section VI.

The key concept in valuing environmental benefits or costs is that of **Total Economic Value** (18). This is defined as:

Total Economic Value = **Actual Use Value** + **Option Value**
+ **Existence Value**

Of these the Actual Use Value is the easiest to comprehend and measure. It derives from the present use of a particular environmental resource. A fisherman, hunter or pastoralist use the environment and the benefit that they derive from it is their use value. Slightly more complex are values expressed through options to use the environment, that is, the value of the environment as a potential benefit as

opposed to actual present use value. Economists refer to this as option value. It is essentially an expression of preference, a willingness to pay, for the preservation of an environment against some probability that an individual or group will make use of it at a later date. Provided the uncertainty concerning future use is an uncertainty relating to the availability, or 'supply' of the environment, this option value is likely to be positive.

The third component of total value, existence value presents more problems. It suggests values which are in the real nature of the thing and not associated with actual use, or even the option to use the thing. 'Intrinsic' value is a value that resides 'in' something and which is capture by people through their preferences in the form of non-use values. They arise because of concern for, sympathy with, and respect for the rights or welfare of non-human beings. Introspection will confirm that there are such values. A great many people value the existence of cultural sites, or sites of religious significance in developing countries, even very poor ones, where the value attached to the site is unrelated to use, although, to be sure, the vehicle by which they secure the knowledge for that value to exist may well be film, or photograph, or the recounted story.

The approaches to the economic measurement of environmental benefits can be broadly classified as direct and indirect techniques. The former considers environmental gains - an improved level of output in agriculture, better levels of air quality or water quality etc. - and seeks directly to measure the money value of those gains. This may be done by looking for a surrogate market or by using experimental techniques.

The surrogate market approach looks for a market in which goods or factors of production (especially labour services) are bought and sold, and observes that environmental benefits or cost are frequently attributes of those goods or factors. Thus, piped water in an attribute or feature of a house, a risky environment may be a feature of certain jobs, and so on. The experimental approach simulates a market by placing respondents in a position in which they can express their hypothetical valuations of real improvements in specific environments. In this second case, the aim is to make the hypothetical valuations as real as possible.

Indirect procedures for benefit estimation do not seek to measure direct revealed preferences for the environmental good in question. Instead, they calculate a 'dose-response' relationship between pollution and some effect, and only then is some measure of preference for that effect applied. Examples of dose-response relationships include the effect of pollution on health; the effect of pollution on aquatic ecosystems, and the effect of soil erosion on agricultural yields.

Indirect procedures do not constitute a method of finding Willingness to Pay (WTP) for the environmental benefit (or the Willingness to Accept (WTA) compensation for environmental damage suffered). What they do is to estimate the relationship between the 'dose' (pollution) and the non-monetary effect (health impairment, for example). Although they have this obvious weakness, they are, nevertheless, frequently used in valuing environment changes, especially in developing countries, where the information available often only permits the use of such methods and data for the calculation of preference based estimates is poor.

2.1 Direct valuation

(a) The Hedonic Price Approach

The value of a piece of land is related to the stream of benefits to be derived from that land. Agricultural output and shelter are the most obvious of such benefits is the environmental quality of the neighbourhood in which the land is located. The property value approach to the measurement of benefit estimation is based on this simple underlying assumption. Given that different locations have varied environmental attributes, such variations will result in differences in property values. With the use of appropriate statistical techniques the hedonic approach attempts to (a_1) identify how much of a property differential is due to a particular environmental difference between properties and (a_2) infer how much people are willing to pay for an improvement in the environmental quality that they face and what the social value of the improvement is.

The identification of a property price effect due to a difference in pollution levels is usually done by means of a multiple regression or similar technique in which data are taken either on a small number of similar properties or pieces of land over a

period of years (time series), or on a larger number of diverse properties at a point in time (cross section), or on both (pooled data). In practice almost all property value studies have used cross section data, as controlling for other influences over time is much more difficult.

Hedonic price techniques have been successfully used in estimating the costs of air and noise pollution, and of changes in amenities, in developed countries. Their use in developing countries and in the agricultural sector has been much more limited. Some use has been made of hedonic techniques in Latin America to value sanitation benefits, and benefits from improved water supply but apart from that their use in any natural resource related activities is non-existent.

Are hedonic price valuations reliable and accurate? The difficulty, of course is, there is no absolutely correct yardstick against which to measure the reliability. If there were, it would not be necessary to engage in hedonic price approaches! It is thus in the nature of non-market valuation that accuracy and reliability have to be tested by other means. The main tests are:

(i) consistency of results in similar contexts;
(ii) consistency of results with other benefit estimation techniques;
(iii) consistency of results with 'real market' experience.

On the basis of these tests, there is considerable evidence to show that hedonic price valuation, properly executed provides reasonably reliable benefit estimates.

(b) The Contingent Valuation Approach

The Contingent Valuation Method (CVM) uses a direct approach - it asks people what they are willing to pay for a benefit, and/or what they are willing to receive by way of compensation to tolerate a cost. What is sought are the personal valuations of the respondent for increases or decreases in the quantity of some good, contingent upon an hypothetical market. Respondents say what they would be willing to pay or willing to accept if a market existed for the good in question. A contingent market is taken to include not just the good itself (an improved view, better water quality

etc.), but also the institutional context in which it would be provided, and the way in which it would be financed.

One major attraction of CVM is that it should, technically, be applicable to all circumstances. Its aim is to elicit valuations - or 'bids' which are close to those that would be revealed if an actual market existed. The hypothetical market - the questioner, questionnaire and respondent - must therefore be as close as possible to a real market. The respondent must, for example, be familiar with the good in question. If the good is improved scenic visibility, this might be achieved by showing the respondent photographs of the view with and without particular levels of pollution. The respondent must also be familiar with the hypothetical means of payment - say a local tax or direct entry charge - known as the payment vehicle.

The questionnaire suggests the first bid (the 'starting point bid (price)') and the respondent agrees or denies that he/she would be willing to pay it. An iterative procedure follows: the starting point price is increased to see if the respondent would still be willing to pay it, and so on until the respondent declares he/she is not willing to pay the extra increment in the bid. The last accepted bid, then, is the Maximum Willingness to Pay (MWTP). The process works in reverse if the aim is to elicit Willingness to Accept (WTA): bids are systematically lowered until the respondent's minimum WTA is reached.

A very large part of the literature on CVM is taken up with discussion about the 'accuracy' of CVM. Accuracy is not easy to define. But since the basic aim of CVM is to elicit 'real' values, a bid will be accurate if it coincides (within reason) with one that would result if an actual market exited. But since actual markets do not exist ex hypothesi (otherwise there would be no reason to use the technique), accuracy must be tested by seeing that:

- the resulting bid is similar to that achieved by other techniques based on surrogate markets (house price approach, wage studies etc.);

- the resulting bid is similar to one achieved by introducing the kinds of incentives that exist in real markets to reveal preference.

One significant feature of the CVM literature has been its use to elicit the different kinds of valuation that people place on environmental goods. In particular, CVM has suggested that existence values may be very important.

CVM has been used extensively to elicit values of improvements in water quality, the benefits of less air pollution, and the option and existence values of species and sites. Values for the latter have been found to be very large in studies conducted in the United States, Germany and the Scandinavian countries. Thus willingness to pay for the conservation of rain forests, thorough CVM and other methods, has been estimated at as much as $8 per adult in the United States (Pearce 1990). In general the view is that CVM can provide reasonable and interesting data on benefits or costs, but the respondent has to be very familiar with the subject matter of the valuation.

Until recently, the direct use of such techniques in developing countries was believed to be very difficult, if not impossible, due to the sophistication of the 'as if' experiments involved. However, some recent work carried out through the World Bank on the valuation of water benefits in Pakistan and Nigeria has shown that the technique can indeed be effectively employed in valuing the benefits of alternative water supply systems. The Inter American Development Bank has also been pioneering the use of CVM in valuing environmental costs and benefits in relation to sewerage, water supply and irrigation projects. Views on the relevance of this method are therefore changing fast and it is quite likely that their use will extend to the valuation of environmental impacts in agricultural areas.

(c) Travel cost approaches

Travel cost models are based on an extension of the theory of consumer demand in which special attention is paid to the value of time. In the developing countries, some models are being used to estimate benefits from tourism development in countries with game parks (such as Kenya, Tanzania, Zimbabwe, Cameroon, South Africa, etc.), or special trekking areas (such as Nepal). Another area of applications has been to value benefits of fuelwood supply (or the supply of replacements such as kerosene), where households 'pay' for the fuelwood by spending time collecting it (the case of many African countries). Finally the World Bank and the Inter American

Development Bank have also been supporting the use of travel cost data as part of the valuation of water benefits referred to above. Thus, travel cost models have a role to play in benefit estimation in developing countries and, moreover, one that should increase in the future.

2.2 Indirect valuation

The procedures for valuing the use of environmental resources thus far have been based on individual preferences. However, other methods exist that do not seek to measure such preferences explicitly. Instead they calculate a "dose-response" relationship between pollution and some effect, and then they apply a measure of preference to that effect. Such methods are referred to as indirect methods. Examples of dose response relationships include the effect of pollution on health; the effect of pollution on aquatic ecosystems; the effect of soil erosion on agricultural productivity and the values of tropical forests. For example, there are now several fairly detailed studies valuing the damage done by soil erosion by this method (19).

The dose response tends to be used particularly for two reasons. The first is when it is thought that people are unaware of the effects that pollution causes. The second is when eliciting preferences by any one of the direct methods is not possible for reasons of data, or lack of 'market sophistication' in the population or both. The second reason applies especially in developing countries, where price and expenditure data are generally poor and where, at least until now, the use of contingent valuation techniques has been limited because it is believed that the answers would suffer from strategic, hypothetical and operational biases.

Where environmental benefit estimation has been undertaken in developing countries, it has been mainly of this form. Some points to note about the use of these techniques in the agricultural sector are the following:

(i) environmental costs and benefits are estimated mainly for changes in agricultural output following land use and land management programmes. However, the dose response relationships on which these are based are frequently quite crude, with no allowance being made for the fact that individuals adapt to changes in their environment. Thus, for

example, as soil conditions change different inputs will be used and different crops grown. Not allowing for that would result in an underestimate of the benefits of such changes;

(ii) many environmental impacts are not valued in these exercises. The reasons range from a lack of data to an unwillingness to use the appropriate techniques. The former include benefits such as increased crop residues and the spillover effects of projects. The latter include benefits of conservation per se;

(iii) where environmental costs are involved, the impact is often dealt with through a requirement that certain standards be met and certain levels of protection be achieved. In these cases no cost or benefit estimation is carried out. The use of such methods is sometimes referred to as 'gated responses'. In these cases, the costs of meeting the standard are considered as part of the costs of the project and often are equated with the 'environmental costs'. However, the latter is a fallacy, as the costs of mitigation may or may not be equal to the costs of the environmental damage. Nevertheless the use of gated responses can be important in project appraisal, particularly in connection with the criteria of sustainability. How they should be designed and carried out is discussed in the next section;

(iv) in other instances, the issue of environmental benefit or cost estimation is avoided by comparing different means of achieving a given goal. The goal has environmental benefits which are assumed to be desirable. The analysis only concerns itself with the cheapest way of achieving this goal at least cost.

SECTION IV

ECONOMIC SOCIAL AND LEGAL POLICIES FOR SUSTAINABLE AGRICULTURE

"Adequate nutrition and food for all remains the threshold at which all other human hopes begin."

Dr. Jacques Diouf
Director-General of FAO
Copenhagen, 1995

1. Economic Policies

Economic policies that have an effect on Sustainable Agriculture can be divided into four groups. First there are those that determine the broad parameters of economic policy nationally such as the exchange rate, monetary and fiscal policy. They are generally classed as macroeconomic policies. Second there are policies that directly affect activity in specific agricultural sectors, such as input price policies, output price polices, and user charges for services provided by the public sector. As a group these would be classed as microeconomic policies. Third there are policies that determine the functioning of markets, such as which natural resource products can be bought and sold and what trades are permitted. Such market policies are closely related to the legal and social practices that define and circumscribe the action of property rights. Fourth, there are policies directly designed to control resource degradation and reduce environmental pollution. Such policies are enacted through a range of environmental instrument, from command and control to sophisticated fiscal schemes acting on economic incentives. Each of these is considered briefly below.

1.1 Macroeconomic policies

In general exchange rate, monetary and fiscal policies will have an effect on natural resource use, although the direct and magnitude is difficult to estimate. For example a policy induced reduction in the real exchange rate is often associated with increased exports of agricultural crops. In Costa Rica, following the 1985 Structural Adjustment Programme, Hansen argued that this resulted in the promotion of perennial with favourable soil-containing characteristics (Hansen, 1988). However, he did not discuss the implication of increased pesticide and fertilizer use that this would also entail. In other cases devaluation has also been associated with increased exports of hardwoods, which may result in further unsustainable use in that sector. Another possibility is that it will encourage the cultivation of marginal lands, as farmers respond to the incentive and seek quick profits.

In general, it is difficult to assess the environmental impacts of macroeconomic policies without a detailed evaluation of specific cases. As a general point, it should be noted that, ideally, such policies are designed to achieve important goals of short term stabilization and long term economic growth and should not be determined with their environmental consequences in mind. This does not mean that one need not be aware of any such consequences; rather it means that environmental impacts need to be dealt with using separate instruments. For example, if exchange rate changes resulted in an increase in soil eroding crops, the appropriate policy would be to counter that effect through agricultural pricing policy or environmental charges but not through the exchange rate. A similar response applies to the criticism that external debt, resulting from past monetary policy, is environmentally damaging because it encourages the mining of the natural resource base. The debt is not of itself a cause of the mining practices, and governments still have at their disposal instruments to limit such practices (20).

Another area where macroeconomic policies may have a bearing on Sustainable Development is through their effect on poverty. Policies of price rises for staple commodities and essential services, so often favoured by structural adjustment programmes, can reduce the welfare and living standards of the poorest sections of society. If one accepts a link between poverty and resource degradation, they can also result in the latter. Although such a link is widely believed to be the case, the

evidence for it is weak. To be sure, in circumstances of extreme famine, individuals will use the resource base without consideration for the future; but in more 'normal' circumstances the poor have as much, if not more, interest in conserving their resource base and using it sustainably as the rich. It is more often than not the breakdown of incentive structures and policies that is responsible for the degradation caused by poverty. In a study of the linkages between poverty and the environment in three areas (West Java, Southern Nigeria and Northern Nigeria) Jagannathan has shown that the linkages between poverty and the environment have been significantly shaped by economic and social policies. "*The poor, like the non-poor, have utilized opportunities brought about by the spatial integration of economic activities, sometimes to the detriment, and at other times to the benefit, of long term renewable resource usage*" (Jagannathan, 1989).

It is now accepted that macroeconomic stability should not be pursued at the cost of the genuine needs and interests of the poor and vulnerable sections of the population as this may well compromise social stability. In order to achieve this:

(a) Structural adjustment programmes must correspond to the economic and social conditions of individual countries and should be designed realistically to reflect the inevitable time lags in the effectiveness of supply-side responses in many African countries and in developing countries in general;

(b) All decisions related to adjustment should include a full examination of alternative ways of securing macroeconomic stability, structural transformation improved efficiency from the perspective of social equity, and should provide the ownership of the macroeconomic programme to the country concerned, to its national government, to its people;

(c) Structural and macroeconomic programmes rooted in accepted national priorities, concerns and aspirations should become development-oriented, so as to enhance opportunities, particularly for the poor and unemployed.

These are the basic considerations to be borne in mind in suggesting macroeconomic reforms for African national governments.

The least developed, land-locked and African small island developing countries, which form a significant proportion of the countries in the African Region, should be accorded special considerations for their intrinsic vulnerability to changes in the international economic and trade environment. The problem posed by the burden of all types of external debt and debt servicing, is very acute for the above group of countries and lower middle-income countries and requires ameliorative action.

1.2 Microeconomic policies

In order to ensure sustainable development, African governments should put in place, comprehensive, timebound plans for the protection, conservation and sustainable use of their natural resource bases, taking into account the needs of those who depend upon them for their livelihood. The cornerstone of such plans must be the need to address the disadvantaged and vulnerable sections of society and to eradicate poverty. These plans should include sustainable land and marine management supportive of the welfare of local and rural communities.

Special attention must be given to the identification and promotion of environmentally sound and sustainable survival strategies, including the enforcement of the property rights of local and rural communities as well as the relocation and resettlement from resource-degraded areas, as a means of encouraging poor rural communities to adopt ecologically viable lifestyles.

Sustained economic development is necessary for sustainable reduction in poverty. It provides extra employment and resources for poverty alleviation. A precondition for sustainable economic development are environmental sustainability, and adequate social development, without which factors such as social unrest, lack of cohesion and security and the absence of a healthy and skilled workforce will limit economic progress. A further precondition is adequate investment in physical infrastructure and in human resources development.

Economic growth on its own will not alleviate poverty. The poor do not benefit automatically from a "trickle down" of new wealth, as shown by continuing poverty in the region despite decades of assistance to Africa.

To alleviate poverty on its own, growth would have to be consistently much higher than is likely. Economic growth will reduce poverty only if it utilizes and benefits the poor. For many countries of the region, this means that initially it should involve labour-intensive, and definitely rural investment. Equity in wealth distribution which is also important can be realized through taxation, or programmes targeted at the poor, including primary health care, water supply and sanitation, education, micro-enterprises and community development.

Putting rural growth first can keep rural and urban development in tandem and reduce the rural-urban gap. It can also mobilize the resources of the rural poor, who form the majority of the poor in many parts of Africa. It should however be noted that rural to urban migration is an inevitable part of economic restructuring. It is nevertheless crucial that this migration be slowed down and whenever and wherever possible, redirected to smaller urban centres integrated with their surrounding rural region.

Neglect of the rural sector during economic and social transition would cause an increase in poverty.

On the basis of studies we have undertaken, African countries which have sustained high agricultural growth have also obtained large reductions in poverty. To the extent that agricultural growth is pursued, it must be through ecologically/environmentally sustainable practices.

Agricultural growth can facilitate non-farm and non-agricultural rural growth, which is important to employment expansion in rural areas. Agricultural and non-agricultural rural growth both require investment in rural infrastructure, including roads, electricity and education, and a countering of any urban bias in investment. Agricultural development in Africa will require continuing research and development, especially into environmentally sustainable and appropriate agricultural technologies including biotechnology accessible to small farmers.

There is no doubt that, government support for the informal sector will not be without problems, precisely because the sector is defined by its being outside of normal government mechanisms. Problems may well emerge on both the government and the informal sector side of the relationship. To some extent, the more support

and recognition are given to the informal sector, the more formal it will become. Nevertheless, approaches which help those in the informal sector to organize themselves should provide channels for government consultation with and support of this sector.

Sustained economic development with transformation involves restructuring to adjust to technological change and to markets that are changing and becoming more global. Such restructuring can have social costs, as shown by the following examples:

1. Moving from agriculture-based industrial production can increase rural poverty and pressure on urban areas;

2. Reducing barriers to free international trade and investment is important to global economic growth, which can facilitate national economic development with transformation and poverty alleviation. However, it can also eliminate industries, cause unemployment and add to living costs. Regional experience suggests that during restructuring, a judicious phase-down of trade barriers or some selectivity in targeting investment can help old industries adjust and new industries develop and help keep trade balances positive by limiting less productive imports;

3. Moving from a non-market economy to a market economy can also cause unemployment, reduce incomes for many unevenly rising costs for food and other essentials;

4. Reducing government deficits, which can stimulate growth, tends to cut the services and support offered to the poor disproportionally;

5. Moving from labour-intensive industrial activities to technology or capital-based industries implies a smaller, more highly skilled workforce, with consequent unemployment and demands on the education and training system.

The costs of economic restructuring fall disproportionally on the poor and other vulnerable groups in society, including women. There is no doubt that restructuring

is essential, but so are the programmes to alleviate the costs. Such programmes should be included in cost-benefit analysis of specific restructuring. Restructuring required for sustainable economic and social development with transformation can also be rendered fruitless if poverty alleviation is not built in from the beginning and the poor fear loss of security, oppose the restructuring and thus heighten social tensions. Relevant programmes could involve the relocation of workers, their retraining, support payments, access to credit for new enterprises, labour intensive construction or new rural infrastructure to facilitate growth in rural production. While such safety nets are not cheap, they can avoid more expensive entrenched poverty later and they share across the community the costs of the development which should benefit the whole community.

The poor should participate in all aspects of policy, planning, programme design, delivery, monitoring, and evaluation of poverty alleviation measures. This can improve the effectiveness of intervention by ensuring their relevance to local circumstances and the commitment of the local community. It recognizes the abilities of the poor to save, convert labour into capital in innovative ways. It can ensure that technology used is appropriate by being locally understood, affordable, maintainable and replaceable. Where Governments can deal with groups of the poor, rather than individual farmers, costs may be reduced. Participatory monitoring by the poor not only allows quick self-corrective action but also helps train them. Conversely, government-designed and delivered programmes often reflect the structure of government administration and services offered by one department rather than the problems of the poor.

Involving the poor can empower them to advocate for themselves and demand their share of resources. Through appreciation of their strengths, the poor become active participants in poverty alleviation, improving outcomes through their resources. Empowering the poor in one area tends to produce carry-over benefits in others. For example, some rural community development programmes use health as an "entry point" to focus rural community action, after which the rural community goes on to other projects, such as improvements in education. This can apply also to food security as "entry-point". Other projects begin with community credit projects and develop into food security projects. Encouraging the poor to own resources collectively, cooperate in credit provision or bargain cooperatively can also give them power relative to land lords, informal credit providers, banks and local administrations.

Government should also widen participation to NGOs which can play a valuable role in facilitating community groups or as advocates, organizers, policy and programme formulators and implementers. Government should also have policies and mechanisms to facilitate private sector participation in poverty alleviation. As major employers and actors in the economy, the private sector can do much to alleviate poverty. It can influence community attitudes by ensuring that rates, working conditions, training, hiring practices and other aspects of employment are safe, adequate and equitable. At times, government regulation and/or organized labour unions, may assist to ensure adequate and equitable practices. Financial institutions should be encouraged to open windows for social lending, perhaps with government support.

There are factors which threaten traditional social security systems, create a demand for formal social security programmes but, because of this demand, hinder their funding and encourage governments to consider contributory or jointly funded schemes, which re-emphasize individual and family contributions, and bloc any progress in sustainable economic and social development with transformation. The factors behind these changes include:

1. Increasing urbanization and industrialization in most countries in Africa and associated reductions in the proportions of extended families;

2. More women in the paid work force with less time available for traditional social security;

3. More people seeking support because of unemployment, partly because of trends away from labour-intensive industries;

4. Demographic changes producing increasing dependency ratios;

5. More people in the informal economy, where coverage with formal social security can be difficult and expensive.

The overwhelming message about microeconomic policies is that they have been frequently misconceived as far as their impact on the environment and on sustainable resource is concerned. Mostly this is because the policies are pursuing

some other objective - increase in exports, income support for low income groups, benefits to powerful sections of society and so on; sometimes it is because the environmental implications have not been fully understood. In both cases policy failure results. A number of examples have already been indicated in Section II. Following the four agro-eco-systems described there, the following are some further examples:

(a) Overgrazing

The problem of overgrazing can sometimes be exacerbated by government policies. In Botswana, the incentives to overstock included subsidies on inputs, the ability to write off losses in agriculture against income from other activities, and a pricing system that offered high prices overall but low prices at the onset of the dry season, reducing the incentive to sell then, and thereby reduce cattle demand on the rangeland at its most susceptible time.

(b) Deforestation

The Brazilian Government, amongst others, had imposed tax regulations that act to encourage deforestation. Cattle ranchers that move into cleared areas of the tropical forest were exempt from land and income tax. As a result, '... with the subsidies, the discounted present value of net returns was nearly 2.5 times the investment outlay. If all subsidies were removed, however, the project would produce a net loss to the investor equal to 0.9 times the outlay' (Barbier). Subsidies to ranching are being phased out but their contribution to deforestation has been significant.

Whilst governments do demand licences, and charge stumpage rates, they fail to take into account the true opportunity cost of virgin forests. The economic value of virgin forest often well exceeds the cost of forest clearance. Through the introduction of higher licence fees, royalties, land rents as well as export and harvest taxes, governments could increase the proportion of the rent captured which would provide an important source of government revenue which perhaps could be channelled into sustainable forest management, as well as creating an incentive to

conserve the resource. The inadequacy of government fees in capturing the potential rent from log harvesting is shown by the fact that in the period 1972-82 official government fees in Indonesia were only 37.5 per cent of the rent the loggers received at the moment of sale. The loggers themselves in turn failed to capitalise on the full value of the logs, government rent capture as a proportion of the potential rent available being only 33 per cent.

Introducing charges levied on the volume of timber removed rather than the volume or marketable timber could also reduce the selective logging process employed by licensees. In Sabah and Indonesia selective logging for high grade marketable timber accounts for between 45-75 per cent of damage to unharvested trees. Legislation in Sarawak, differentiating between species of timber has been successful at limiting damage to unharvested trees but in most countries, tax concessions, subsidies and price distortions have exacerbated the inefficiency associated with forest clearance. Ghanaian Plymills use $2.2m^3$ of logs to produce a cubic meter of output, while Japanese mills only use $1.8m^3$ to produce the same level of output. In China the existing stumpage rates only cover 1/3 of the costs of reforestation, while deforestation rates exceed annual growth by approximately 30 per cent (Gammage, 1990). The potential exists to raise charges as present levels are only a proportion of retail market prices, this increase in revenue could be used to ensure logging processes operate sustainably.

(c) Irrigated agriculture

It is estimated that 10 million hectares of cultivated land has been lost in India through waterlogging and 25 million hectares are threatened with salinisation. Waterlogging and salinisation can result in part from uncontrolled forest clearance. This was found to be the case in Pakistan, following the deforestation of the mangrove forests. Soil erosion connected with the forest clearance lead to an increase in salinity levels and a deterioration of valuable breeding grounds of shrimps and other fish species. It also occurs as a result of excessive irrigation or inadequate drainage. As shown earlier, controlling the salinity level and the water table height are important environmental considerations. Approximately 40 per cent of the world's irrigation capacity is affected by salinization (Gammage, 1990).

Charges applied to water consumption in Africa as well as in developing countries in general, are at levels which fail to cover operating and maintenance costs (Anderson, 1990). More seriously, it appears that the rate of use is excessive and environmentally damaging. Hence the potential exists, both to increase charge levels to encourage water conservation and to improve cost recovery, thereby providing resources for further investment in the sector. Fees for water could be related to land enhancement and increased crop production rather than continuing a charge system based on irrigated acreage which ignores actual consumption levels. The argument that low water charges are necessary to benefit low income groups is countered, in part, by Anderson who indicates that subsidies on water supplies have generally favoured high income consumers at the cost of restricting capacity in lower income areas. The high marginal values for water in developing countries have resulted in the existence of large net benefits for certain groups of farmers. These net benefits, also referred to as economic rents represent the difference between what the price the farmer is willing to pay for irrigated water and the price actually paid. For example a World Bank study shows that in Mexico the charges amount to 11-26 per cent of the willingness to pay, with farmers accruing 74-89 per cent of the benefits as a rent (Repetto, 1988). A good use of available water in Africa, could increase the African irrigated agricultural area to 200 million ha against 10 million ha presently.

(d) Marginal lands

As was shown in Section II, farming on marginal lands can be carried out sustainably and productively if the right technology is used and if the right incentives are present. Often, however, this is not the case. Subsidies on inputs such as pesticides and fertilisers serve to increase use and shift to cropping patterns that are not sustainable and that require increasing applications over time.

(e) Pesticides

African as well as many Third World governments give pesticide subsidies in an attempt to achieve higher growth rates and larger yields. Repetto shows that pesticide subsidies range from 19 per cent of the retail cost in China to 89 per cent in Senegal (Repetto, 1988). However, the continual use of pesticides not only leads

to a situation where insect pests and weeds are increasingly resilient but where farmers are contracting pesticide-related diseases. The use of pesticides in Pakistan, particularly in the paddy field areas, has resulted in water supply contamination, and hence the poisoning of water buffalo and water fowl found often in the area. Fish stocks in Indonesia, Malaysia and Thailand have diminished considerably because of poisoning related to pesticide use. The subsidies to farmers take the form of tax and tariff concessions, low interest farm credits as well as direct subsidies.

The pattern of use of pesticides is militating against the smaller farmer. Such groups are forced to use pesticides to control the insects and weeds, but as the pests become more resilient this becomes an increasingly expensive task. Small farmers and the hired labourers in particular also suffer the stomach upsets and rashes related to pesticide use. The potential for control does exist; a removal of subsidies would not significantly harm small farmers, if as evidence would appear to indicate subsidies do not always reach their target anyway. This would release a significant portion of revenue which could then be used to attack other areas of need.

(f) Fertilizers

Fertilizer subsidies have been provided to increase the productivity of areas of land which have suffered soil loss, as well as to give an incentive to engage in private planting of trees and agricultural crops. However, excessive use of fertilizers can impair both the taste of produce and induce a faster deterioration period. The impact of fertilizer use can also adversely affect health, as thorough cleaning can still leave fertilizer residues on fruit and vegetables, which may lead to stomach upsets and uncomfortable rashes. A potential exists to increase the price of fertilizers through a removal of subsidies but there is the fear that this could exacerbate the problem of water-logging and salinisation as farmers turn to increased use of irrigation. In Ngadas, East Java fertilizer subsidies were found to be encouraging inefficient agricultural management. Subsidies would appear to retard the adoption of conservation measures and environmentally benign methods such as 'green manuring', mulching and compost application. However such techniques are very unlikely to achieve the output levels attained with conventional fertiliser applications and they must be regarded as applicable only in selected marginal areas (Norse, 1988).

1.3 Environmental instruments

Environmental instruments are designed to deal specifically with environmental pollution and degradation. They are divided into three groups: regulatory instruments, economic instruments and persuasive measures.

(a) Regulatory instruments

This area of environmental regulation is typically known as the area of 'Command and Control' policy. Most countries use regulatory instruments as a basis for control measures, upon which they can build. Regulation can take the form of standards for emission and discharge levels, restricting economic activity to certain times or areas, and licensing product use. Compliance is mandatory, and non-compliance may result in fines, and imprisonment. '...governments have typically tended to resort to regulatory instruments coupled with systems of monitoring and sanctioning of non-compliance' (Opschoor, 1989). In general the implementation of 'Command and control' policies is weak in developing countries. Sometimes the parties are not even aware of regulations, fines are rarely imposed for infringements and payoffs to inspectors are frequent;

(b) Market policies

In many cases environmental damage can be reduced if the person responsible for a resource is also the one who stands to gain or lose from the sustainable exploitation of that resource. For example, many forests that are exploited in a non-renewable fashion would not be if the benefits of non-timber use and other non-use values could be expressed through some kind of market. It has been found that in Peru the marketable value of forest products such as latex and fruit may actually exceed the timber values (Peters, et al., 1989). Similarly if ecotourism could be exploited there would be less attraction in deforestation. Another way of capturing the 'value' of such a resource is to sell it to foreign NGOs and local counterparts to mange it sustainably. This has been done successfully under debt of nature swaps in Costa Rica and Mexico.

Several methods can be used to create market incentives but they all depend on the legal and institutional framework being adaptable and flexible. In many cases it is a question of controlled rights to access, themselves organised under a variety of regimes; in others it is a matter of creating the possibility of trading resources. For example, if water and fish use is to be limited, it can increase the efficiency of any imposed quotas if individuals are allowed to trade their allocations. Such schemes exist in developed countries but not, as far as can be ascertained, in developing ones.

Thus there is considerable scope for market creating policies to operate and improve the use of resources towards a more sustainable pattern of use. However, this should not be seen as a blanket statement in favour of 'market forces' in the natural resources sector. There are many instances where such markets could result in considerable damage as externalities are ignored. It is a question of the right market incentives.

National policies, especially fiscal and monetary policies, should aim at creating a climate of confidence which will encourage and stimulate employment growth and investment in job creating activities. Another lesson is that no sustained expansion of productive employment can take place without growth (although the reverse is true) and countries have to pursue appropriate policies in this direction, keeping in mind that growth can take place without jobs creation.

(c) Economic instruments

The relevant instruments as far as this document is concerned are Charges and Subsidies.

(i) Charges

Charges reflect the additional price the polluter must pay to pollute or deteriorate, i.e. to have an implicit claim on environmental services. They can have both a revenue raising purpose as well as an incentive function. In the majority of cases the charges that have been implemented have had only revenue raising and redistributive functions, as charge levels are too low to have much incentive impact.

The revenues collected may be used as subsidies for pollution abatement equipment, for research and for the subsidising of new investment. It is probably true to say, however, that no such charges have been levied in developing countries in the agricultural sector. Tax differentials and input and output subsidies and taxes are common but they are not imposed with the idea of correcting for any environmental damage. Some environmental charges for fertilisers and subsidies are now being considered and applied in advanced countries but the experience with them is still limited. Nevertheless the potential for such charges remains strong.

(ii) Subsidies

Subsidies imply financial assistance which, for the case of environmental protection, must persuade the polluter to alter his behaviour and comply with existing standards. They may be related to the reduction of emissions of pollution, or to the use of specific. A critical feature of subsidy schemes is how they are financed. One method is to employ user charges on the product to finance the subsidy. An example would be to place a general water charge to finance purification. Another method would be to use general budgetary allocations to finance subsidies. The actual receipts could be in the form of grants or soft loans. A third methods is the use of revolving funds. These are funds that are initially created for the use of soft loans but which are recycled on repayment of past loans. Finally there is the possibility of using tax allowances as a form of subsidy, as in the case of land clearance tax allowances in Brazil.

Many of the subsidies that exist in African countries are on fertilizers and pesticides and on services such as the provision and disposal of water. These subsidies are environmentally damaging in many cases. In addition there are implicit subsidies in the form of tax concessions for forest clearance that also have environmental implications. As has already been argued in this document, the removal of these subsidies would have at least two benefits: a reduction in the environmental damage and an increase in government resource mobilization. Examples of positive environmental subsidies would be a subsidy on kerosene on the grounds that it reduces deforestation by reducing the demand for fuelwood; or the issue of free or subsidised seedlings (India, South Korea) if farmers assist in the arrest of soil erosion; or tax concessions for farmers that engage in private tree planting. One major

drawback to the use of subsidies in these countries is the limited capacity of the public sector to raise the necessary funds. Another is the difficulties in implementing the schemes without maladministration and corruption.

1.4 Persuasive measures

This involves encouraging environmental awareness and responsibility into the individual decision making processes. Pressure can be applied both directly and indirectly to ensure 'voluntary' agreements between resource users, farmer and governments on environmental issues. It also includes education, awareness programmes etc. The potential for persuasion is substantial, but its effectiveness in the long run depends on a continued incentives for the agents concerned to continue with the 'good practice'.

Given the limited use of these policies it might seem premature to discuss the arguments for and against the alternatives. Nevertheless there is a considerable literature that does just that, and that evaluates alternative instruments in different situations. These evaluations are almost entirely based on the experience of developed countries. However, the lessons learned from these are valid for the developing countries as well, where the basic focus on environmental regulation, such as it is, has been on limited command and control policies.

The broad criteria for such an evaluation are:

- cost efficiency - i.e. how does the economic cost of this measure in terms of lost output, resources devoted to pollution abatement etc. compare with others;

- administrative and other costs of compliance. Apart from the costs identified under cost efficiency, there are costs of implementing and ensuring compliance with the measure;

- impact under uncertainty. In many cases the damage done and the costs imposed on others by the pollution and the controls are not known accurately. How robust is the measure to uncertainty about these costs;

fiscal impacts. Measures undertaken using government funds may raise difficulties regarding resource mobilization; others may enhance that capability;

political acceptability. Is the measure likely to be acceptable at the political level.

The argument has sometimes been advanced that fiscal instruments of the kinds described in the previous section are inappropriate for developing countries. However, this is not the view we are taking here. The use of charges and other revenue generating instruments (such as trading permits) is, if anything, even more attractive in such countries. The well known problems of limited powers of resource mobilization in them would suggest that where taxes can be raised from a well defined source, and with little chance of evasion, it should be taken.

The other area where African countries need to concentrate their efforts is on the effective application of user charges. As has already been pointed out, such charges rarely cover operating costs of services such as water. To some extent this has also been the case in developed countries, but the change to a system of pricing that not only covers fixed and variable average costs, but also varies the charge according to the quality of water drawn from and emitted onto the water body is taking place. There are some technical problems in the way of implementing such tariffs in developing countries but these can be overcome. The real difficulties are political.

2. Social and Legal Policies

The move to sustainable agriculture will require a number of reforms in terms of titling, access to resources and property rights. The issues involved are complex, and most commonly held views about property rights are found to be incorrect, at least in some cases. Here are a number of examples:

- there is only one study (in Northern Thailand) that supports the proposition that the issuance of secure land titles will result in increased investment by farmers in their land. A review of the African experience

concludes that, on balance, titling and land registration does not seem to have any impact in agricultural investment Barrows and Roth, 1988). In Costa Rica squatters have been known to invest as much as $100 per ha. in fencing without any formal title to the land (Lutz and Daly, 1990).

there is no evidence anywhere that land titling and registration will reduce pressures on the resource base.

in many cases the problem is one of the enforcement of rights and covenants rather than the granting of them. In Niger, a 'land to the tiller' policy resulted in large landowners expelling their tenants in fear of losing their land. In Madagascar, sharecropping is prohibited but is widely practised. In Sri Lanka, slash and burn cultivation is prohibited but is still practised. There are many such examples (Bloch, 1990).

Clearly the issue of land security and access is of great importance, and needs to be addressed in conjunction with the economic and other policies. However, security is determined by many factors other than legal title and these have to be examined in detail before any recommendations can be made.

SECTION V

ENVIRONMENT AND NATIONAL ACCOUNTING

> "If the soil on which all agriculture and human life depend is wasted away by erosion, by human neglect, by non accountability, the battle to free mankind from want cannot be won"
>
> John Boyd Orr
> First Director-General of FAO

There is considerable scope for the use of some of direct techniques in the valuation of environmental benefits in African countries, and in their rural sectors, but this has yet to be substantially exploited. Particular promise holds for contingent valuation methods and travel cost approaches. However, it is essential to note that such models really only provide 'orders of magnitude' to the size of the benefits, and that some inaccuracy is inherent in the nature of the task being attempted. Nevertheless, the values obtained are useful in reaching rational decisions with regard to investments involving such benefits.

Although there would appear to be little direct relevance of non-user values to agricultural projects and policies, such an impression is misleading. Non-user values such as option and existence value can, for some natural resources, be so large as to influence conservation decisions. These in turn can have a major impact on sustainable agriculture. As indicated in Section I, environmental values are of use, both in investment decision making (project appraisal) and in policy making (national accounting). Each of these is considered below.

At the beginning of this document it was stated that a proper accounting of natural resource use and environmental degradation was potentially a useful contribution to Sustainable Agricultural Development. This Section also examines the progress made in the area of environmental accounting and what it has achieved in terms of guidance to policy makers in this area in Africa.

1. Programme/Project Appraisal in Agriculture and the Inclusion of Environmental Impacts

The starting point of programme/project appraisal is the definition of the 'unit of account'. This measures the units in which costs and benefits are measured. In developing country studies two units are commonly used: one is consumption at domestic market prices and the other is uncommitted income to the government at border prices. The former is the unit recommended by the UNIDO guidelines manual and the latter is recommended in the little-Mirrlees method for project appraisal for developing countries (Squire and van derTak, 1972). The unit of account is an important concept because it indicates that costs and benefits are not worth the same, dollar for dollar, irrespective of what they are used for (e.g. investment or consumption) or where they come from (e.g. private savings or public savings, or reductions in consumption). The choice of the unit of account also has implications for the choice of the discount rate, a point that is developed later in this section.

An important point that needs to be noted, and that is often misunderstood is that, although the costs and benefits are reported in money terms, they do not necessarily correspond to an actual identifiable cash receipt or payment by any one individual. For example, a project concerned with the construction of a dam may identify increased incidence of waterborne diseases as a result of the construction. Such diseases have costs to society in the form of loss of output, or in terms of willingness to pay to avoid the illness, but these costs will not appear as a cash payment by the suffers once the dam is built. To the extent that the production activities of the affected parties are in the monetary sector, there will be reduced cash outputs, but this will only represent part of the health costs.

Conversely, just as there may not be cash flows corresponding to particular costs and benefits, so the actual cash flows that do take place may not represent the true costs and benefits flowing from the economic activities that generate them. A typical example would be when domestic prices are above border prices,[7] the former resulting from an overvalued exchange rate and domestic taxes. (This is in general the case of many African countries). In that event it is the opportunity cost of the

[7] The concept of "border prices" as conventionally used does not meet our acceptance. It is used here for reasoning purpose.

resources used in the sector that need to be measured. Usually, but not always, these are given by the border prices of the commodities in question or, where the goods are not traded, the cost of production using border prices to value inputs.

The essential message here is that there is only a weak link between cash flows and observed market prices, on the one hand, and the figures that are used to calculate costs and benefits on the other. For the benefit cost analysis to be effective and credible it must include all relevant costs and benefits, including those that do not have a corresponding direct cash value. Furthermore, it must adjust the prices of those that do have cash values to take account of price distortions in the economy.

Once costs and benefits have been valued in the appropriate unit, a decision criterion is applied to judge whether or not the programme/project is justifiable. Typically three indicators are reported: a net present value (NPV), an internal rate of return (IRR) and a benefit cost ratio (B/C). If programme/project appraisal is to contribute to sustainable agricultural development it is important that external costs and benefits be included in the appraisal of programmes/projects. This requires using valuation methods such as those described above. However, not all benefits can be so valued although it is evident that such benefits are there. In such cases a judgment as to be made of what actions need to be taken to ensure sustainable land use in connection with a whole group of similar projects, and appropriate policies have to be instituted to ensure such use at less cost. This is similar to what was earlier referred to as a 'gated response', except that what is being proposed here is (a) that such conservation or environment - protecting investments be undertaken on this basis only when valuation is not possible and (b) that they be undertaken in connection with a programme of investments (e.g. all watershed developments or all rural road building projects) rather than individual investments. It constitutes what Barbier Markandya and Pearce have referred to as a sustainability criterion for programme/project appraisal (Pearce, 1990). This criterion is also relevant in connection with discounting and the environment, an issue that is discussed below.

2. Environmental Issues and the Choice of the Discount Rate

To many individuals concerned with the environment, the fact that programmes/projects are selected using a NPV criterion with a discount rate of around

10 per cent in real terms, using an IRR criterion with a similar required rate, is a reason why the environment is inadequately protected by such processes. They argue that the high discount rates do not give enough value to future environmental benefits or costs and that the emphasis of such allocation rules is to go for short term programmes/projects, without paying enough attention to the long term implications.

The choice of the discount rate will also depend on the choice of the unit of account; with costs and benefits measured in consumption units, the discount rate should be the consumption rate of interest, which would tend to be low - around 2-6 per cent. With public income as the numeraire, the appropriate rate is the accounting rate of interest, which is approximately a weighted average of the consumption rate and the opportunity cost of capital. It tends to lie between 5 per cent and 8 per cent. In both cases the rate is below the kinds of rates used in programme/project appraisal by most agencies - e.i. 10-12 per cent (Markandya and Pearce, 1988).

There is some justification in the 'environmentalists' criticism, but it needs to be viewed with care. First, many environmentally useful programmes/projects do satisfy the requirement of a high rate of return and the latter does not singularly discriminate against them. Second, high rates also discourage development programmes/projects that compete with existing environmentally benign land uses, eg. watershed development as opposed to an existing wilderness use. Third, it is argued that a high discount rate is necessary to allocate scarce capital in capital starved countries. This, however, is only a partly valid point, as the allocation of capital can be carried out using other criteria, such as a shadow price premium on capital in the cost benefit analysis itself.

In spite of these counter arguments, the issue of the discount rate remains a matter of concern, as a number of environmentally desirable programmes/projects or components will not satisfy the high discount rate criterion and, as a result, the process of development supported by such an allocation rule may not be sustainable. There are essentially two ways round this problem. One is to use a lower discount rate where 'environmental' programmes/projects are concerned. This however, raises the problem of how to choose the projects that benefit from the lower rate - after all many programmes/projects have environmental effects. It also introduces complications of the allocation of funds that many governments would wish to avoid. The second alternative is to impose what has been described above as a sustainability

criterion on programmes/projects with environmental impacts. Precisely how the criterion is made operational has not yet been worked out, but one possibility is that a constraint be imposed that, in any year, the environmental and natural resource capital of a region must not diminish. This would in turn imply the need to carry out compensatory projects to satisfy this constraint. Such programmes/projects need to be evaluated in accordance with some cost efficiency rule but need not meet a specific rate of return requirement.

3. Failures of GNP and GDP

"National accounting", has written Wilfred Beckerman in a standard introduction to the topic, "*is simply a systematic way of classifying the multitude of economic activities that take place in the economy in different groups or classes that are regarded as being important for understanding the way the economy works*" (Beckerman, 1968, p. 68). Beckerman acknowledges that "*there is an arbitrary element in many of the decisions that have to be made in drawing up a classification system for the National Accounts*", and is at pains to stress that there is nothing sacrosanct about the present way the accounts are structured:

> "*It must be emphasized that there is a constant evolution and change in the questions the economists are asking, in the institutional structure of the economy, and in the working hypotheses that economists use for purposes of analyzing the behaviour of the economy. In accordance with these changes, so it will be necessary to modify and adapt the classification system used for national accounting. It would be useless to persist with a classification system, for example, that no longer corresponded to the institutional and social categories of society, or to the latest knowledge about how the economy operated and so about which relationships were important for analytical purposes. ... It is to be expected that the appropriate National Accounts classification will, as the years go by, be subject to far-reaching modifications*" (ibid., pp.5-6).

This is also the view of Robert Eisner, who noted in his authoritative survey of proposals to amend or extend the National Accounts: "*The accounts are not set in concrete. ... From the early days of their formulation there have been lively debates*

as to just what they should include, how items ought to be measured, and how they are to be put together. They have been modified over the years" (Eisner, 1988, pp. 1611-12).

These quotations from definitive texts on national accounting show that proposing to adjust the National Accounts for newly important economic facts or perceptions is neither subversive nor eccentric. Rather it is indicative of continuing open-mindedness in economic science, whereby even the most settled procedures are open to modification if new conditions render it desirable. The "new conditions" in this case are the myriad ways in which economic activity is degrading the environment, as we have stated before.

When the National Accounts were being systematised in the 1940s, environmental issues had a low perceived importance, and the accounting structure adopted simply ignored environmental issues, as one of the essentially "arbitrary" judgements referred to by Beckerman. The National Accounts have now matured into the fundamental instrument of macroeconomic management and means of indicating economic progress. It is frankly inconceivable that national strategies for sustainable development will cut any ice economically unless they are integrally related to the national accounting system. The European Community certainly recognised the importance of this when, in its Fifth Action Programme on the Environment, it stated categorically: "*Environmentally adjusted National Accounts should be available on a pilot basis from 1995 onwards for all Community countries, with a view to formal adoption by the end of the decade*" (EC, 1992, p. 97).

This political imperative for environmental adjustment of the National Accounts reinforces the intellectual and economic imperatives. The National Accounts' current treatment of environmental issues can only be justified intellectually if these issues are economically unimportant. If these issues are now crucially important to humanity, and are intimately related to economic activity, as the Rio Summit made clear, then the National Accounts' treatment of them is bizarre and indefensible. Moreover, it is economically misleading. As discussed below, a number of studies (e.g. Repetto et al., 1989 for Indonesia, Solórzano et al., 1991 for Costa Rica, Adger, 1992 for Zimbabwe, Van Tongeren et al., 1993 for Mexico, Bartelmus, Lutz & Schweinfest, 1993 for Papua New Guinea) have shown that GNP growth rates and net capital

formation can be greatly overstated by failing to account properly for natural resources.

In short, for intellectual, economic and political reasons, the adjustment of the National Accounts for environmental factors has now become a priority.

(a) The importance of the environment to production

The first, and perhaps most important, question the National Accounts are intended to answer is: "How much does the national economy produce?" To answer this question the National Accounts must be, and are, based on a clear theory of production and definition of national product, which, according to Beckerman, is "*the unduplicated value of the flow of goods and services produced by the nation in the time period concerned (usually a year)*" (Beckerman, 1968, p. 31). If the environment is to be included in the accounts, then it must be incorporated consistently into this theory and definition.

Current theory (21) abstracts from the physical reality of production. It even omits the third commonly recognised factor of production, *land* (capital and labour being the other two), so that there is no scope for analyzing the environmental contribution to production in such a model. As Nordhaus & Tobin have said: "*The prevailing standard model of growth is basically a two factor model in which production depends only on labour and reproducible capital. Land and resources, the third member of the classical triad, have generally been dropped. The simplifications of theory carry over into empirical work. The thousands of aggregate production functions estimated by econometricians in the last decade are labour-capital functions*" (Nordhaus & Tobin, 1973, p. 522).

More recently there have been attempts to incorporate at least some aspects of the environmental contribution. Thus the work of Jorgenson & Wilcoxen (1993) implies a production function, where the new variables are energy and intermediate material inputs respectively[8]. Such a formulation obviously enables the contribution

[8] $Y = F(K,L,E,M,t)$

of energy to production to be studied but it still omits an analysis of the environment's wider contribution.

Figure 3 is a diagrammatic representation of a production process, which includes "environmental flows" rather than just those of energy. The diagramme is adapted from Ekins 1992 and is consistent with the description of production by Harrison (1993, pp. 25ff.) and Bartelmus & Tardos (1993, p. 185), in connection with their discussion of integrated economic and environmental accounting.

The figure portrays three kind of capital stock: ecological (or natural) capital human (individual and social) capital, and manufactured capital. Each of these stocks produces a flow of "services" - environmental, E, labour, L, and capital, K, services - which serve as inputs into the productive process, along with "intermediate inputs", M, which are previous outputs from the economy which are used as inputs in a subsequent process.

Manufactured capital comprises material goods - tools, machines, buildings, infrastructure - which contribute to the production process but do not become embodied in the output and, usually, are "consumed" in a period of time longer than a year. Intermediate goods, in contrast either are embodied in produced goods (e.g. metals, plastics, components) or are immediately consumed in the production process (e.g. fuels). Human capital comprises all individuals' capacities for work (skills, knowledge, health, strength, motivation) and the networks and organisations through which they are mobilised.

Ecological capital is a complex category which performs three distinct types of environmental function, two of which are directly relevant to the production process. The first is the provision of resources for production, the raw materials that become food, fuels, metals, timber etc. The second is the absorption of wastes from production, both from the production process and from the disposal of consumption goods. Where these wastes add to or improve the stock of ecological capital (e.g. through recycling or fertilisation of soil by livestock), they can be regarded as investment in such capital. More frequently, where they destroy, pollute or erode, with consequent negative impacts on the ecological, human or manufactured capital stocks, they can be regarded as agents of negative investment, depreciation or capital consumption.

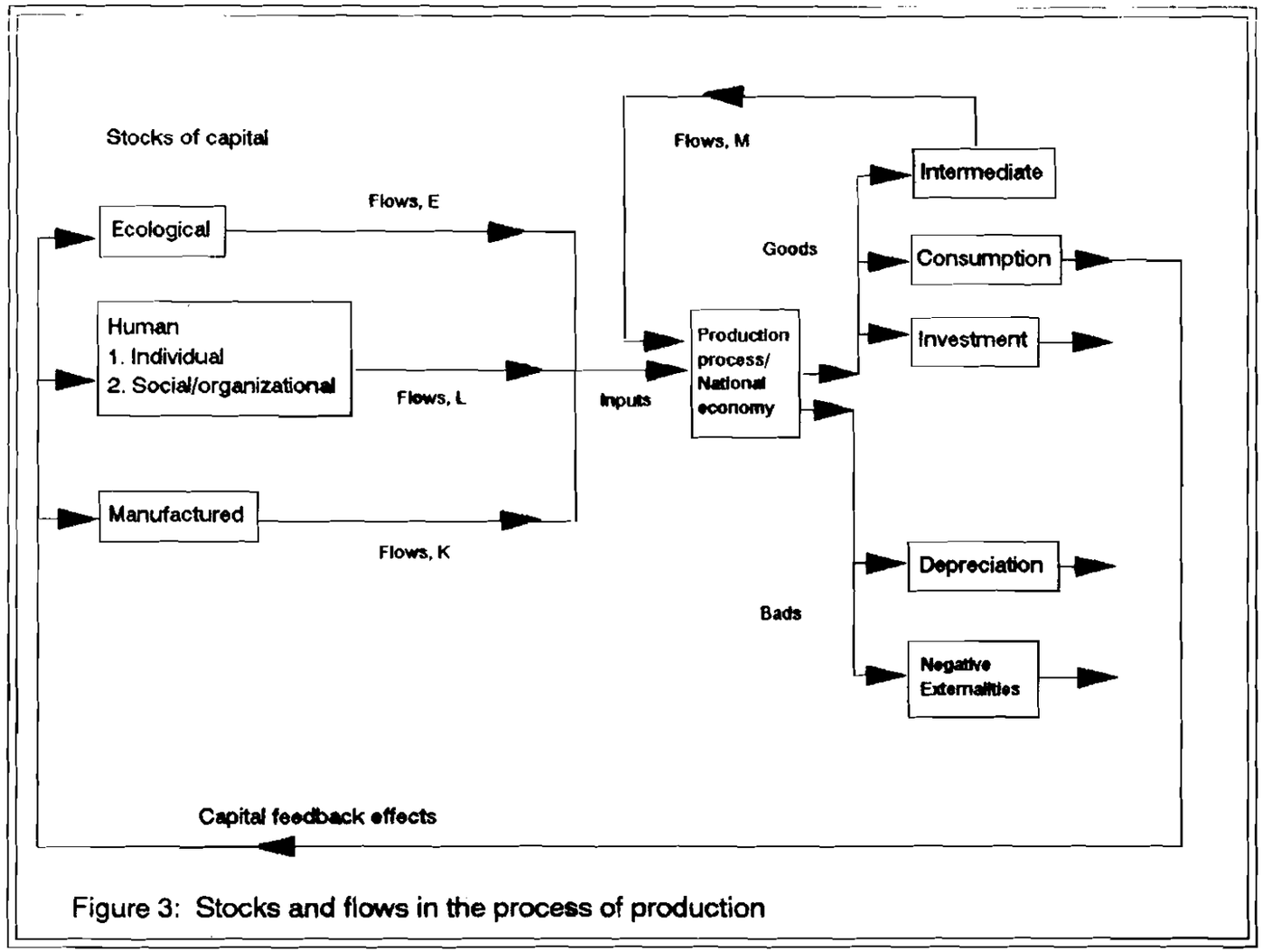

Figure 3: Stocks and flows in the process of production

The third type of environmental function is not shown here because it does not contribute directly to production, but in many ways it is the most important type because it provides the basic context and conditions within which production is possible at all. It comprises basic "survival services" such as those producing climate and ecosystem stability, shielding of ultraviolet radiation by the ozone layer and "amenity services" such as the beauty of wilderness and other natural areas. These services are produced directly by ecological capital independently of human activity, but human activity can certainly have an (often negative) effect on the responsible capital and therefore on the services produced by it.

The outputs of the economic process can, in the first instance, be categorised as "Goods" and "Bads". The Goods are the desired outputs of the process, as well as any positive externalities (incidental effects) that may be associated with it. These Goods can be divided in turn into consumption, investment and intermediate goods and services. The Bads are the negative effects of the production process, including capital depreciation and negative externalities, such as those contributing to environmental destruction, negative effects on human health etc. In so far as they have an effect on the capital stocks, the Bads can be regarded as negative investment.

The necessity for a matter/energy balance on either side of the production process means that all matter and energy that feature as inputs must also emerge as outputs, either embodied in the Goods or among the Bads. On disposal of the former, therefore, all these former inputs are returned to the environment, to the stock of ecological capital, where they may have a positive, negative or neutral effect. The essential point is that, for matter, figure 3 represents a closed system; for energy, inputs can be received from the sun, and heat can be radiated from the earth into space.

(b) Construction of the National Accounts

Figure 3 identifies as a "production process" any humanly-organised combination of flows from the capital stocks which results in the production of desired outputs, Goods. It makes no distinction between flows of inputs that are paid for and those that are not; or between outputs that are marketed and those that are

not. However, these distinctions become important when one wishes to quantify the flows and outputs, which is, of course, the principal purpose of the National Accounts, to arrive at a figure for "national product".

The National Accounts are presently constructed by defining a "production boundary", which distinguishes between "productive" and "non-productive" activities. As Beckerman notes, "*the dividing line between what is and what is not a productive activity is necessarily arbitrary in any system of National Accounts*" (ibid., p.8). The current dominant convention is that where the flows of goods and services are accompanied by corresponding flows of money (in the opposite direction), then they are part of the national product. Where they are not thus accompanied, they are not part of the national product. The principal exceptions to this rule are the residential services provided by buildings to owner-occupiers and the home-grown food consumed by farmers, the values of both of which are estimated ("imputed") according to reigning market prices and added into the national product. With few such exceptions a flow of goods and services that is not accompanied by a money flow is not considered part of the national product, or GNP. Similarly, any flow of money that is not matched by a flow of goods and services (such as the payment by government of old-age pensions or unemployment benefit) is called a "transfer payment" and is not added to the national product.

Finally, care must be taken in the accounting of intermediate goods and services. If their value is counted as part of national product; and if the value of the goods and services to the production of which they contribute (which will include their value) is also counted as part of the national product, then the value of the intermediate goods will have been counted more than once - "double-counting" will have occurred. Therefore the national product must be counted either from the value only of "final" goods and services, those which are sold directly for consumption of investment (which will include the value of all intermediate goods); or it must be calculated by summing the value-added from each industry, the payments only for capital (including rents) and labour services in each industry. National product computed in either of these ways will include the value of intermediate goods only once.

This method of constructing national product is shown in figure 4. The double lines show the flow of goods and services into and out of the production sector,

which produces intermediate, consumption, investment and export goods. The single lines show the flows of money, in the reverse direction to the flow of goods. Households comprise people as workers, who provide labour services (L), and as owners (of firms and property), who provide capital services (K,E', where E' is that part of ecological capital which is marketed). For these services workers are paid wages (W), shareholders receive profits (P) and property-owners receive rents (R). These comprise household factor incomes. There then take place various transfer payments between people and government (taxes, T, and government benefits, Tr), from which households and governments emerge with net incomes H and G respectively. Some of this income is spent on imports (M). Otherwise households purchase domestically produced consumption (C) or investment (I) goods, according to whether they spend or save (S) their incomes. Government expenditure (G) is also spent on investment or consumption goods. Exports are bought with the money of foreigners (X).

The flows of money, adjusted for imports and exports, are circular: the production sector pays out incomes from the value-added which it generates, which it receives from expenditures on its products. The value of the national product is the value of the expenditures on it, but, because of the circular flow of the money concerned, this must be equal to the factor incomes and the value-added generated in production. The figure obtained by calculating any of these totals is called Gross Domestic Product (GDP). GNP is obtained from GDP by adding in net property income from abroad.

The use of the term "income" as above, while usual, is not strictly correct. The strict definition is that of John Hicks: "*We ought to define a man's income as the maximum value which he can consume during a week, and still expect to be as well off at the end of the week as he was at the beginning*" (Hicks 1946, p. 172). The factor incomes identified above are not "income" in this sense, because no allowance has been made for the capital depreciation that has taken place in generating them. The National Accounts recognise this and calculate a figure for this depreciation, or capital consumption, deducting it from GNP to arrive at Net National Product (NNP), which is also called National Income.

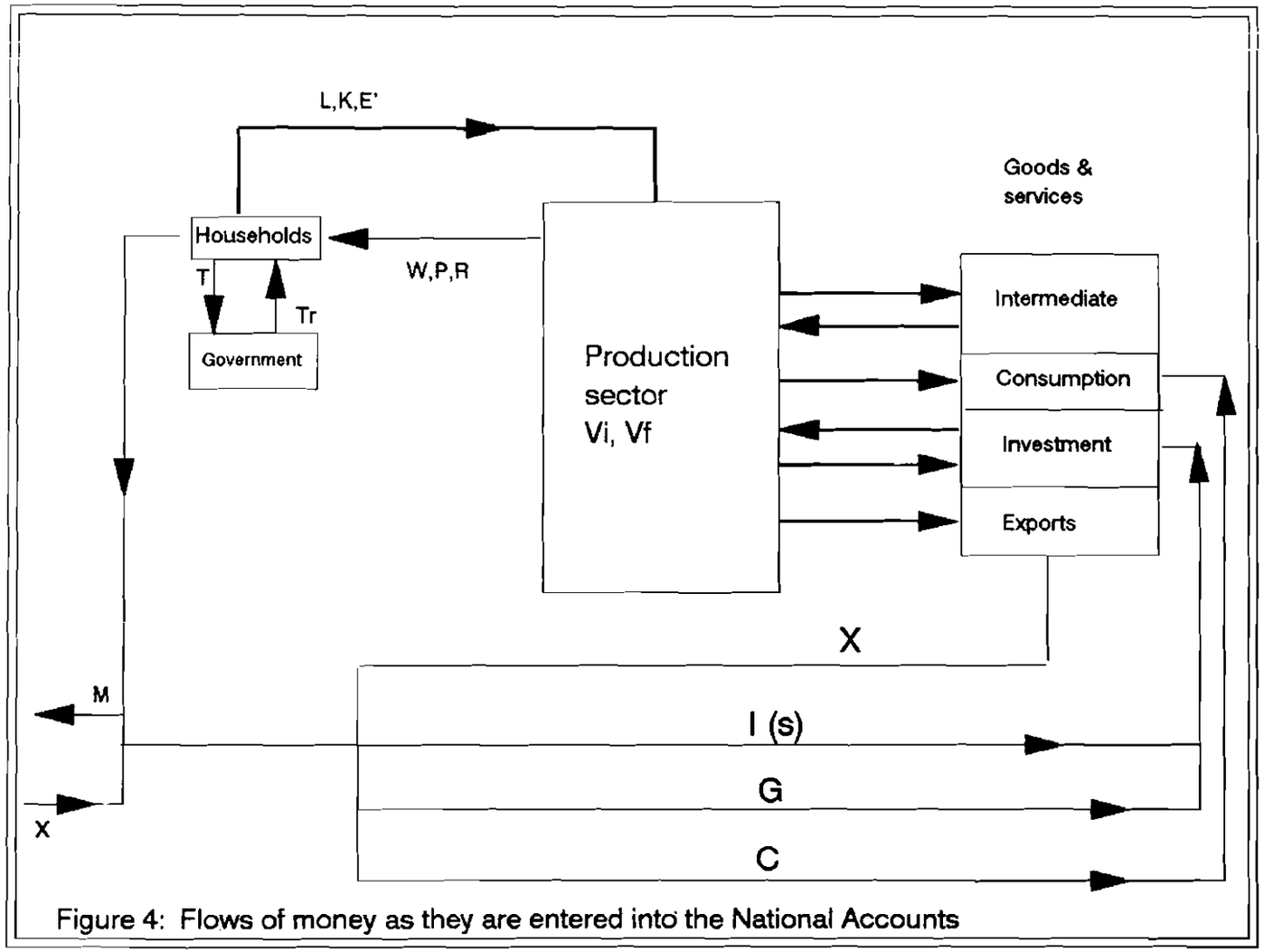

Figure 4: Flows of money as they are entered into the National Accounts

(c) Causes for concern in the National Accounts

Comparing the full model of production described here and the method of calculating the National Income, it can be seen that there are three major ways in which the National Accounts fail to give a correct assessment of income, as defined by Hicks.

The first is the summary exclusion of practically all non-monetary production, so that GNP as calculated will be substantially less than a "Total Product" which included non-monetary, including household, production. But the error introduced by excluding non-monetary production goes furtner than this, for monetary and non-monetary production are not independent of each other. One of the main characteristics of industrial economic development has been the transfer of activities (e.g. cooking, washing, cleaning, child-care, education) from the household, family and community, where they were not paid for, to market-settings (e.g. restaurants, launderettes, cleaning firms, nurseries, schools) where they are paid for. The National Accounts calculated as above show the whole of the new market activity as growth in production, whereas the actual net product of the transfer is the difference between the value of the new market activity and the value of the non-monetary production it replaced.

It was to avoid an anomaly of this sort that the decision was taken to include in national product the imputed rents of owner-occupied households. Otherwise GDP would have decreased by the amount of the rent every time a tenant bought the house he or she was renting (and increased every time an owner-occupier became a tenant). This would obviously have been an absurd situation. It is, however, precisely analogous to the situations identified by Pigou (1932, pp. 32-33), such as that whereby, under current conventions, GDP decreases by the amount of her pay when a man marries his housekeeper, even if she performs the same tasks after her marriage as before, though without a wage. More contemporaneously, one might ask by how much GDP overstates the increase in production when a married couple is divorced, and both individuals get full time jobs and start paying for services which before they rendered freely to each other.

Therefore the exclusion of non-monetary production from GDP not only understates real production. Given the shift of activities towards the market that

occurs with modern economic development, it also systematically overstates economic growth. It also denies the value of non-monetary work, which discourages and discriminates against those who do it, still mainly women. For all these reasons non-monetary production should be brought into the National Accounts. Goldschmidt-Clermont (1992, 1993) has described clearly how this could be achieved by shifting the production boundary to include these activities as "productive", and then calculating their value, on the basis of comparison with their nearest market equivalents, in accordance with current national accounting conventions. The implementation of such a method is overdue, but is, perhaps, in prospect. As Goldschmidt-Clermont (1993, p.419) notes: "*According to the currently available information, the 1993 SNA recommends the inclusion of part of households' non-market production within the production boundary*". (The other part is recommended to be included in a satellite account, as discussed below.)

The second major area of omission in the National Accounts is their failure to assess changes in human (including social and organizational) capital. Growth accounting has now developed very detailed ways of differentiating between different qualities of labour input. For example, the model described in Jorgenson 1990 cross-classifies labour inputs "*by the two sexes, eight age groups, five educational groups and two employment statuses - employee and self-employed*" (Jorgenson, 1990, p. 35). Clearly these different qualities of labour input, which have different productivities, issue from a heterogenous human capital stock, which could, in principle, be valued either according to the productivity of associated labour services, as expressed by the present value of the streams of incomes to which the stock gives rise; or according to the inputs required to create, maintain and increase it. In practice, however, the task appears too ambitious. While it is beyond contention, for example, that malnutrition degrades human capital, that does not mean that all food expenditures should be regarded as investment in such capital, nor would it be possible to distinguish between food "consumption" and food "investment" without making a plethora of arbitrary assumptions and running into huge data problems. This is also the case for expenditures on health and education, which are the other principal components of human capital creation and maintenance.

If human capital is statistically intractable, social and organisational capital is even more so. Harrison is in no doubt about the importance of this kind of capital, which she calls institutional capital: "*Economic behaviour does not take place in a*

vacuum. Rather it consists of a large number of agents interacting according to a known set of norms and conventions. These are enshrined in the laws and customs of the country through the formal and informal activities of the governing body" (Harrison, 1993, p.26). In addition to political and legal institutions, social and organisational capital includes firms, business associations, trade unions, voluntary groups and families, for all these organisations play an important role in monetary and non-monetary production. But, as Harrison says: "*Just because the importance of institutional capital is recognised, however, does not mean it can be represented in economic terms. ... Even less than human capital (to which of course it is linked) can it be associated with specific expenditures or approximated in money terms*" (ibid., p.26).

The issues of human capital and non-market production are discussed in great detail in Eisner's 1988 survey of proposed national accounting extensions. What is notable is that Eisner practically ignored the third great area of failure of the National Accounts, their treatment of the environment. Partly this was due to the lack of worked-out environmental adjustments for Eisner to include in his empirical review. But the virtual omission of the environment from the conceptual and methodological discussion also indicates the low profile this issue had among national income accountants at that time. The change of attitude in relatively few years has been striking, and restores the issue of the treatment of the environment in the National Accounts to an importance it had in an earlier period of environmental awareness, the 1970s. Then, one of the fathers of national accounting had written:

> "*Pollution, depletion and other negative by-products of economic production were greatly accelerated because of the very rapid rise of total output... Economic production, and the technology that it employs, may be viewed as interference with the natural course of events, in order to shape the outcome to provide economic goods to man. All such interference has potential negative economic consequences - pollution and the like - the more lasting, the higher the level of production technology as measured by its capacity to produce goods*". (Kuznets 1973, p. 585).

Herfindahl & Kneese (1973, pp. 447-48) were confident about the implications of these "negative ecological consequences" for the National Accounts:

"*The exclusion of the services of clean air, clean water, space, etc. from the list of final goods probably is not the result of disagreement that the services provided by nature are a factor in true welfare, but rather of the judgment on the part of the income accountant that obtaining acceptable estimates for these values would be too difficult and costly. It is clear, however, that any reduction in the service flows of common property resources that is viewed as a loss of real product as compared with the total flow from the truly relevant and larger list of final goods and services. In the extreme case the 'true' service flow could actually decrease while NNP rises*".

Juster (1973, p.66) agrees: "*The environment is clearly worse today than it was in the mid-1950s, and comparison of real output between these two periods is already over-stated because environmental deterioration has been permitted to occur*".

This effect can be considered in terms of the concept of ecological capital developed earlier. As was then seen, the economic functions of the environment include the provision of resources, the absorption and neutralisation of wastes and the provision of other services independently of human agency. In the process of economic activity, resources can become depleted (and, in the case of non-renewable resources, are bound to become so) and the environment can become degraded through pollution or occupation (change of use). Exactly analogously to the consumption of manufactured capital, continuing depletion and degradation imply that the environment will in the future be able to fulfil its functions less effectively or not at all. Yet in many cases these functions are of vital importance to economic, and wider human, life. It is for this reason that current use of the environment is perceived as "unsustainable": it cannot be envisaged to continue.

The calculation of GNP and National Income (NNP) give no inkling of this increasingly serious unsustainability, which is far more pronounced than in the early 1970s, despite the fact that, as discussed earlier, the standard definition of income is as a sustainable quantity. It is this inconsistency in the accounts' treatment of the environment that is one of the components of the recent upsurge of concern over the issue, which has led one economist, Jan Tinbergen, a Nobel Laureate who, like Kuznets, was among those responsible for the early development of the national

accounts, to say that, because of them, "*society is steering by the wrong compass*" (Tinbergen & Hueting, 1993, p.52).

One of the differences between the 1990s and the 1970s is that there now exist a number of quantitative estimates of adjustments that would need to be made to the National Accounts for them to reflect environmental depletion and degradation. The detail of how the adjustments have been calculated is not discussed explicitly in this document. Here some of the estimates themselves will be reported to give an idea of the quantities involved.

The aim of estimating these numbers is to make some assessment of the value of the ecological capital stock that has been depleted or degraded as a result of the processes of production and consumption, i.e. as a result of economic activity. This restriction of the focus to economic activity is simply because this is the focus of the National Accounts. Any attempt to adjust the accounts must start from the same area of concern.

Bartelmus et al. (1993, p. 108) have set out the three basic shortcomings of the National Accounts with regard to the environment: "*National Accounts have certain drawbacks that cast doubt on their usefulness for measuring long-term environmentally sound and sustainable economic development. For one thing, they neglect the scarcities of natural resources that can pose a serious threat to sustained economic productivity. For another they pay only limited attention to the effects of environmental quality on human health and welfare. In addition, they treat environmental protection expenditures as increases in national product, which could instead be considered social costs of maintaining environmental quality*".

With regard to the first of these points, the depletion of natural resources, several studies have now computed a partial estimate of these. Van Tongeren et al (1993) calculated the value of the depletion of oil and forests in Mexico in 1985. They find that this depletion amounted to 5.7 per cent of Mexico's GDP. More seriously, perhaps, for Mexico's future production prospects, they found that net capital accumulated fell from 11 per cent to less than 6 per cent of NDP when depletion was accounted for. The sectoral effects are, predictably, even more pronounced. Forestry and oil extraction made a contribution to unadjusted NDP of 0.54 and 3.50 per cent respectively. When depletion was taken into account their

contribution fell to 0.15 and 0.00 per cent - that is, this study accounted all of oil extraction's contribution to NDP as capital consumption rather than the generation of income (figures from Van Tongeren et al., 1993, table 6.9 p.100, table 6.12, p.105).

Adger (1992) produced estimates for Zimbabwe for 1987. He found that depletion of ecological capital due to soil erosion and forest loss reduced the net product of Zimbabwe's commercial and communal agriculture sector by 30 per cent and Zimbabwe's NDP by 3 per cent. Adger further analyzed the true economic results of a surge in minerals production in 1991 following the devaluation of the Zimbabwean dollar. In nominal terms the sector's conventionally calculated net product grew by 18 per cent; but depletion grew from 20 to 27 per cent of this net product. When this is taken into account the adjusted net sectoral product only grew by 7 per cent (rather than 18 per cent). In real terms, the sectoral growth was 5 per cent rather than the conventionally calculated 7 per cent (figures from Adger, 1992, table 4, p. 19).

The World Resources Institute has also done two studies of this kind. Solórzano et al. (1991) found for Costa Rica that the loss of three resources - forests, soil and a fishery - grew from 5.67 per cent of NDP in 1970 to 10.5 per cent in 1988. Capital formation was even mor drastically affected: net capital formation was lower by 38 per cent in 1970 and 48 per cent in 1988, if depletion is taken into account (figures from Solórzano et al., 1991, table 1.2, p.7, table 1.3, p.9). For Indonesia, Repetto et al. (1989, p.6) found that subtracting the depletion of oil, forests and soil from the country's GDP reduced its average growth rate over the years 1971-1984 from 7.1 to 4.0 per cent. The study also showed that in some years, using these calculations of the depletion of just these three resources and contrary to the conventional accounts, net investment in the Indonesian economy was negative: "*A fuller accounting of natural resource depletion might conclude that in many years depletion exceeded gross investment, implying that natural resources were being depleted to finance current consumption expenditures*" (ibid., p.6).

Repetto et al. (ibid., pp.2-3) spell out the implications of their study, which are also applicable to the other studies cited. Under the current system of national accounting, "*a country could exhaust its mineral resources, cut down its forests, erode its soils, pollute its aquifers, and hunt its wildlife and fisheries to extinction, but measured income would not be affected as these assets disappeared ... The*

difference in the treatment of natural resources and other tangible assets confuses the depletion of valuable assets with the generation of income. ... The result can be illusory gains in income and permanent losses in wealth".

Bartelmus et al.'s second basic environmental shortcoming of the National Accounts was their failure to account properly for economically-induced environmental degradation and its effects on human health and welfare. The effects on human health and welfare can entail two types of costs: actual monetary expenditures incurred to "defend" against the effects; and losses of health, production or welfare due to a lack of such "defensive expenditures".

The defensive expenditures due to degradation are simple to calculate in principle because they represent actual monetary flows, although data in the required desegregation may not always be available. The other losses are clearly a more difficult category of ecological capital consumption to measure than either the defensive expenditures or the depletion of such resources as oil, timber and fish that was investigated earlier. Because there are no corresponding monetary flows, monetary values have to be imputed to these losses using a variety of methods none of which is totally satisfactory.

The study of Van Tongeren et al. (1993) that has already been cited makes an estimate for Mexico in 1985 of the costs of a variety of forms of land, water and air degradation and pollution. The authors find that these costs are 7.6 per cent of NDP and no less than 67 per cent of net capital accumulation. When these costs are added to the resource depletion costs given earlier, to give a figure of ecological capital consumption that includes both depletion and degradation, this figure is 13.4 per cent of NDP and capital accumulation becomes -2.3 per cent of NDP, i.e. instead of the economy having net investment of 11.2 per cent, as the conventional accounts showed, it had net disinvestment of 2.3 per cent, when ecological capital was accounted for. This is a chronic situation of economic, as well as environmental, unsustainability.

Another calculation of the costs of ecological degradation comes from Cobb & Cobb (1944) for the US, as part of their calculation of an Index of Socioeconomic Welfare (ISEW), which also included the calculation of some depletion costs. For 1986 their calculated costs of air, water and noise pollution plus long-term

environmental degradation amounted to 17 per cent of US GNP (15 of the 17 per cent was long-term environmental degradation, which was a largely speculative figure, but the pollution costs were conservative). Their costs of depletion of non-renewable resources and loss of farmland and wetlands amounted to 7 per cent of US GDP. Thus, even leaving long-term degradation out of account completely, ecological capital equivalent to about 10 per cent of US GDP was consumed in 1986 (figures from Cobb & Cobb 1994, table A.1, pp. 82-83).

Interestingly, Cobb & Cobb find that their ISEW decreased by 7 per cent from 1980 to 1986, although GNP rose by 11.6 per cent over the same period, giving an empirical example of the theoretical possibility noted by Herfindahl & Kneesel as quoted above, 20 years ago.

Bartelmus et al.'s third category of National Accounts anomalies was the treatment of environmental protection expenditures. These are expenditures that prevent environmental degradation rather than trying to defend against or compensate for it. However, they are normally included in calculations of defensive expenditures. Leipert (1989a, table 1, p. 852) has calculated that environmental protection expenditures in Germany in 1985 were 1.48 per cent of GDP. The costs of environmental degradation, excluding health costs, were less, 0.80 per cent of GDP. This is in stark contrast to the Mexican case, where Van Tongeren et al. (1993, p.98) estimated that environmental protection services were only 5 per cent of the value of the environmental degradation cost.

There is a long and still unresolved debate over the correct treatment of defensive expenditures in the National Accounts. But, however they are to be accounted, no-one denies that they are costs arising from unintended effects of production and consumption. If the economic activity was not going to or did not bring about the unintended effect, then there would be no need to incur the costs and society would be better off.

Finally, it must be remembered that in all the studies cited above the authors are cautious about the accuracy of the actual numbers calculated. However, it is also true that they only try to measure a small fraction of the environmental depletion and degradation, in the economies concerned, so that the total ecological capital consumption could be very much higher than their estimates. To arrive at the full

environmental costs incurred by the economy, omitted health and welfare effects of the depletion and degradation would have to be considered as well.

(d) From production to welfare

The view of two authors from the UK's Central Statistical Office is blunt: "*The National Accounts measure activity involving economic exchanges. They do not measure, nor claim to measure, sustainable development or welfare*" (Bryant & Cook, 1992, p. 99). It is worth quoting at some length Herfindahl & Kneese's exposition of the conditions for NNP to be a useful welfare indicator.

> "*If it were true that all salient goods and services were exchanged in markets; that the degree of competition in these markets did not change; that the programmes of government and non-profit institutions did not change in such a way that they produced substantially altered welfare relative to the final goods and services that they absorbed; that population stayed constant; and that the distribution of income did not change; then alterations in real NNP ... could be regarded as a good indicator of changes in the economic welfare of the population.*
>
> *This is an imposing string of assumptions, none of which is ever exactly met in reality. ... In fact, the distance between reality and these assumptions is large and significant in some cases, thus seriously reducing the practical usefulness of NNP as a welfare measure. ... The designers of the accounts thought that at best they would serve to provide only a rough indicator of one dimension of welfare*". (Herfindahl & Kneese, 1973, p.446).

Despite the theoretical consensus on this matter, GNP and NNP continue to be widely used as indicators of welfare, both in popular discourse and in academic work. Beckerman provides a clear example of academic ambivalence on this issue. He is clear that income and welfare are not the same thing: "*With exactly the same income and prices and quantities today as yesterday, and without any change in my tastes ... I may still be less happy today than yesterday on account of some change in economic circumstances*" (Beckerman, 1968, p.167). Yet five pages later, without

so much as an invocation of *ceteris paribus*, he is proposing to discuss "*how to measure differences in real income, which we will equate with economic welfare*" (ibid., p.172, emphasis added).

Examples of the use of GDP as a welfare measure abound in practical work. Thus, to take the global warming issue, Boero et al. report in their survey of the CO_2 abatement literature: "*Even if consumption were proportional to GDP, welfare is not proportional to consumption, and so measuring the costs of abatement in terms of GDP is not ideal. However, given that this is the almost universal metric, GDP is the main focus of this survey.*" (Boero et al., 1991, p.S3, emphasis added).

This issue was addressed explicitly by Nordhaus & Tobin in a seminar paper in 1973. "*GNP is not a measure of economic welfare. ... An obvious shortcoming of GNP is that it is an index of production, not consumption. The goal of economic activity, after all, is consumption. Although this is the central premise of economics, the profession has been slow to develop, either conceptually or statistically, a measure of economic performance oriented to consumption, broadly defined and carefully calculated*" (Nordhaus & Tobin, 1973, p.512). Yet, in his influential paper on the economics of the greenhouse effect 18 years later, Nordhaus explicitly employs the GDP metric as a welfare measure: "*We assume that it is desirable to maximise a social welfare function that is the discounted sum of the utilities of per capita consumption*" (Nordhaus, 1991, p.925). Consumption in the paper is expressed in terms of GDP.

In order to relate welfare to the earlier discussion of production, figure 5 introduces welfare into the model of figure 3. Welfare is seen to be affected by many factors apart from the consumption of produced goods and services, including the process of production (working conditions), the institutions of production (family, community, political/legal system), people's state of health (part of human capital) and environmental quality (negative externalities and the stock of ecological capital).

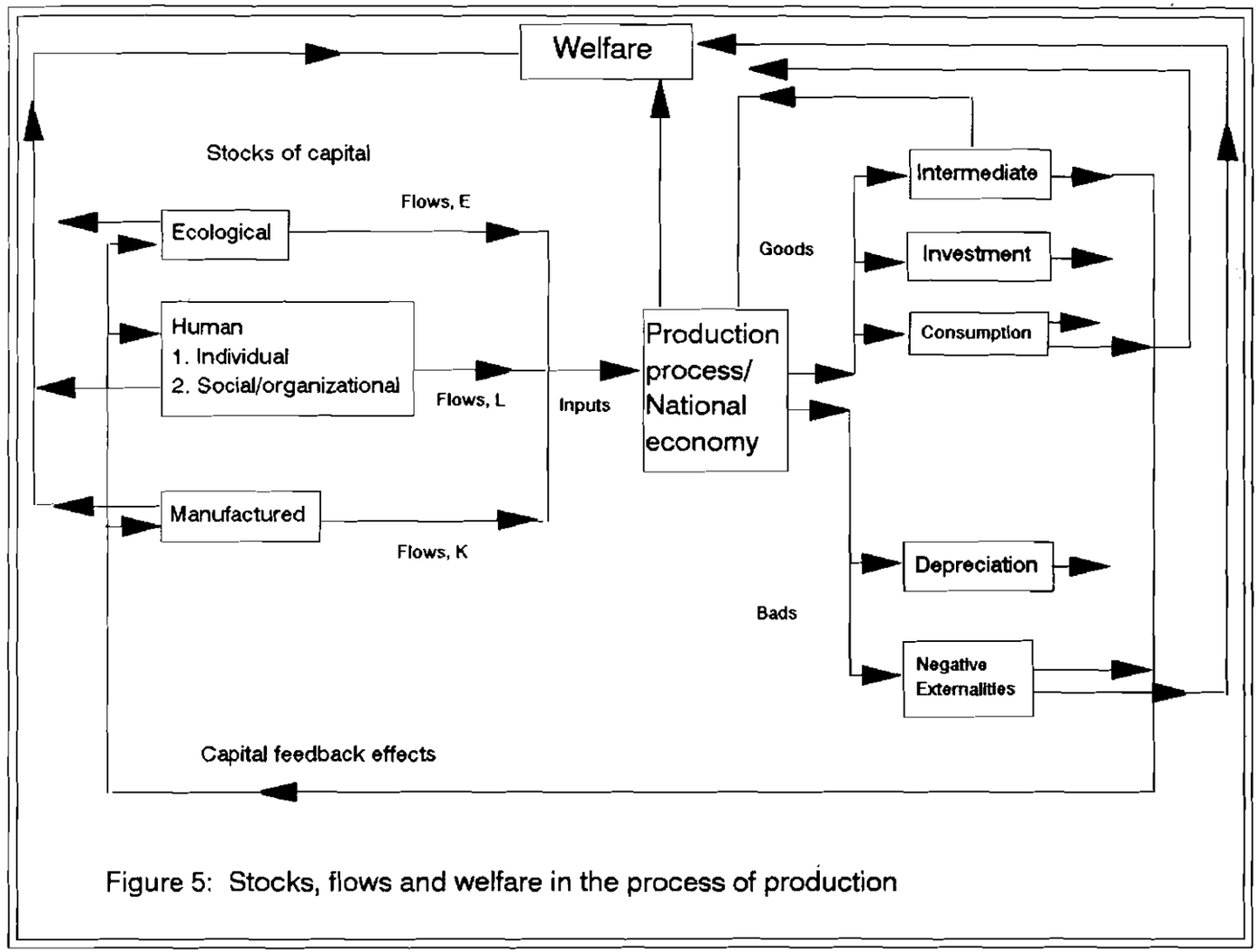

Figure 5: Stocks, flows and welfare in the process of production

It is of doubtful usefulness to seek to define "consumption" to include the effects of all these factors, as Nordhaus & Tobin recommend (see above). It seems more satisfactory to acknowledge that economic welfare is a function of the stocks, flows and processes related to production, and of its social, economic and environmental outcomes (including consumption and income distribution). This seems to be the approach taken by Pearce et al., who consider "development" - "implying change that is *desirable*" (and therefore equivalent to an increase in welfare) - to be "a *vector* of desirable social objectives; that is, it is a list of attributes which society seeks to achieve or maximize. The elements of this vector might include:

- increases in real income per capita;
- improvements in health and nutritional status;
- educational achievement;
- popular participation;
- access to resources;
- a 'fairer' distribution of income;
- increases in basic freedoms.

"*Correlation between these elements, or an agreed system of weights to be applied to them, might permit development to be represented by a single 'proxy' indicator, but this is not an issue pursued here*" (Pearce et al., 1990, pp. 2-3). A very similar approach was taken by Hueting (1986, pp. 243ff.), who identified welfare as having the components production (income), environment, employment, working conditions, income distribution, leisure and safety of the future.

Much of the 1973 paper by Nordhaus & Tobin in fact comprised an attempt to calculate a proxy welfare measure, called Measure of Economic Welfare (MEW), through some reclassification of GNP final expenditure, imputations for capital services, leisure and non-market work, and deductions for disamenities of urbanisation. The detail of the calculation need not concern us here, but Nordhaus & Tobin's conclusion is significant, in that it seemed to confirm a rough correlation between GDP and welfare: "*Although GNP and other national income aggregates are imperfect measures of welfare, the broad picture of secular progress which they convey remains after correction of their most obvious deficiencies*" (ibid., p. 532).

Seventeen years later Daly & Cobb came to a very different conclusion, both by interpreting Nordhaus & Tobin's figures differently, and on the basis of their own calculation of an Index of Socio-Economic Welfare (ISEW). With regard to the former they note: "When (Nordhaus & Tobin's) findings are more carefully examined for time frames other than the full period from 1929-65, the relatively close association between per capita GNP and MEW disappears" (Daly & Cobb, 1990, p.79). In particular, if the period 1947-65 is chosen, the difference between the growth of GNP and MEW (both per capita, hereafter PC-GNP and PC-MEW) is striking: 48 or 2.2 per cent per annum for PC-GNP, 7.5 or 0.4 per cent per annum for PC-MEW. This leads Daly & Cobb to conclude: "*With their own figures, Nordhaus & Tobin have shed doubt on the thesis that national income accounts serve as a good proxy measure of economic welfare*" (ibid., p.80).

ISEW makes different adjustments to GNP to MEW, including giving consideration to resource depletion and environmental damage, so the two indices are not strictly comparable. However, the general trend in ISEW is similar to that of MEW for at same years: PC-GNP growth from 1950-86 was 2.02 per cent, while PC-ISEW grew by 0.87 per cent. From 1970-86, while PC-GNP roughly maintained its 2 per cent growth rate, PC-ISEW actually declined, at an increasing rate (-0.14 per cent from 1970-80; -1.26 per cent from 1980-86) (ibid., p.453).

From an environmental point of view, one of ISEW's most interesting insights is: "*Efforts to control air pollution and reduce accidents have paid off by improving economic welfare during the 1970s and 1980s. ... Improvements in both areas have had the effect of countering the generally downward trend in ISEW. They offer evidence that the choice of policies by government can indeed have a positive effect on economic welfare even if they do not increase physical output*" (ibid., p.454). However, Daly & Cobb's overall conclusion from ISEW is in stark contrast to the generally rosy GNP record: "*Despite the year-to-year variations in ISEW, it indicates a long-term trend from the late 1970s to the present that is indeed bleak. Economic welfare has been deteriorating for the least a decade, largely as a result of growing income inequality, the exhaustion of resources, and the failure to invest adequately to sustain the economy in the future*" (ibid., p.455).

The diversity of Pearce et al.'s and Hueting's lists of welfare's components, the acknowledged difficulty and arbitrariness of attaching either money values or

appropriate weights to them for the purpose of aggregation, and the failure of such efforts as the calculation of MEW and ISEW to generate a methodological consensus, or even a research programme to generate such a consensus, raise the question as to whether in fact the derivation of a single "proxy" indicator for welfare is a feasible objective. Both Ruggles and Miles conclude that it is not: "*No amount of imputation can convert a one-dimensional summary measure such as the GNP into an adequate or appropriate measure of social welfare*" (Ruggles, 1983, pp. 41-43) and: "*Despite many approaches to the modification of GNP, some of which have provided more or less useful statistical innovations, they have not resulted in, and cannot result in, any single indicator which can do for welfare or quality of life comparisons the sort of thing which GNP has achieved for economic output. ... The search for a single indicator of progress is misguided. Social reality is too complex for it to make any sense to collapse its manifold dimensions into a one-dimensional scale*" (Miles, 1992, pp. 288, 296).

This is probably a realistic conclusion. Unlike the environmental adjustments to the National Accounts which have been discussed, in order to improve their accounting of production and concerning which a considerable commonality of opinion has now been achieved, for welfare it would seem preferable to promote the adoption of a framework of indicators, of which EDP or ESNI (Environmentally Sustainable National Income) would be one. This framework would seek to convey the dimensions of social and economic welfare more effectively than any single indicator could hope to do.

(e) Adjustment of the National Accounts

The time is ripe for the implementation of adjustments to the National Accounts for environmental factors. There is now broad agreement on the underlying principles of such adjustment and, as Lutz has said, "*the pressing need is not to devise more theory or techniques, but to apply the existing methodology to concrete problems*" (Lutz, 1993, p.10).

Such adjustment could lead to an Environmentally-adjusted Domestic Product (EDP) or Environmentally Sustainable National Income (ESNI), which, with calculations for household domestic product, could be incorporated into a broad indicator

framework intended to assess socio-economic progress. Such a schema, and its possible components, are discussed in more detail in Ekins & Max-Neef 1992, Chapter 8 (pp.231-313).

Just as the methodologies and definitions underlying the present National Accounts have generated debate and dispute since their inception, so any broader indicator framework will be continually subject to criticism and possible further amendment. This is as it should be where fundamental values are concerned and where perceptions of what constitute wealth and welfare, in a broad sense, are bound to change.

As far as the value of the environment is concerned, there is, of course, much still to be learned. But much is also known and now needs to be brought formally into the accounting framework. As El Serafy (1993, p.21) has said: "*our approach should be gradual and we should attempt to bring measurable elements into the process as our knowledge improves. But to wait until everything falls properly into place means that we shall have to wait forever*".

This is an echo in an environmental context of the earlier call by Eisner: "*There is more to economic activity than what is measured in conventional accounts. ... Perhaps the private research has shown enough in the way of possibilities for presenting a systematic set of accounts of a greater totality ... It is time for the major resources of government to be put to the task. The pay-off can be great, for the economy as a whole as well as for national income accounting*" (Eisner 1988, p.1669). Perhaps the largest pay-off of all would be greater operational clarity about the achievement or otherwise of environmentally sustainable development.

4. National Accounting

Physical environment data can be categorized into two closely related sets of variables: those with an immediate impact on the quality of life and those with a longer-term or delayed impact. Among the immediate impact variables are living space per person, sanitation services, supply of safe water, electricity supply and transport and communications. Among the delayed impact variables are

deforestation, land degradation, fauna and flora species extinction, depletion of the ozone layer and the so-called greenhouse effect.

The immediate impact variables tend to correlate positively with national income and economic growth, while the delayed impact variables tend, in general, to worsen as per capita income rises.

There are essentially two approaches to environmental accounting - a physical approach in which sources and uses of resources are quantified, and used to develop measures of environmental change as well as measures of ecological stress; and a monetary approach that attempts to adjust existing national income accounts for non-valued changes in the environment and in the resource base. The latter is concerned to derive a measure of 'sustainable income' - i.e. the flow of goods and services that can be maintained indefinitely given the man-made and natural capital in the resource base. Physical accounts'were initially worked on by the Norwegian Government beginning around 1974. Monetary accounting can be traced back to the work of Nordhaus and Tobin in 1972.

Physical accounting systems such as the Norwegian have documented environmental and material resources in a systematic way, indicating where they are being used and how and to what extent they are being replenished. The data collected have been used to prepare forecasts of future uses of these resources and their environmental impacts. The exercise has been more successful with respect to some resources, such as land and water than others; and consequently it has had a bigger impact with those than with forests, fisheries, minerals and air quality. In France similar extensive systems of physical accounts have been developed, but their use in economic planning is still unclear.

In developing countries, such an exercise would be of some interest if it could provide the basis of a set of sustainability indicators. What is required in this approach are indicators of system health or integrity, based on the ability of systems to self-organise and on population levels including species diversity. A variety of such measures have been proposed. The following are taken from Schaeffer (1988).

- changes in numbers of native species
- overall regressive succession

changes in standing crop biomass
changes in relative energy flows to grazing and decomposer food chains
changes in mineral micro-nutrient stocks
changes in the mechanisms for and capacity for damping oscillations

Although each of these could be measured as part of a separate exercise, the task of setting up a physical accounting system would provide the basis for consistent data gathering and its use in predictive and forecasting exercises. To date, however, no such system has been instituted, although physical accounts for livestock have been developed in Botswana (Perrings et al., 1989).

Monetary environmental accounts need to make three major adjustments to the conventional national income accounts. They need: (a) to deduct depreciation of environmental assets; (b) to deduct the amount spent by households and farmers on protecting themselves from the environmental pollution that is present, and (c) to deduct the damage done by the environmental pollution to the extent that individuals do not mitigate its effects. The reason for the first is simple - when assets such as soil and forests or fish stocks are exhausted the process generates income but there is no corresponding loss for depreciation in the measurement of national income, as there should be. The reason for the second is that such expenditures (also referred to as defensive expenditure) represent the cost of pollution and degradation rather than something undertaken for its own sake. Finally the third item represents a decline in welfare and should be accounted for simply because national income is supposed to measure the level of welfare or well being in society.

In practice, there are many difficulties in making these adjustments. Technical issues of how to allow for the depreciation of natural assets have yet to be resolved; the treatment of defensive expenditures is still in doubt and there are rarely enough data for pollution damage to be valued in developing countries. In spite of these, however, attempts have been made, at least to allow for asset depreciation in Indonesia, and the World Bank is undertaking studies in Costa Rica and Mexico. The most important thing that has to be done is to value the loss of assets such soil, forestry and exhaustible assets such as petroleum. When this was carried out in Indonesia, the measured growth in income over the period 1971-1984 fell from 7.1 per cent per annum to 4.0 per cent (Repetto et al., 1989).

The key question is what does this imply for policy? At the macroeconomic level, decision-makers are expected to predict the growth in GDP of their policies. If they can be convinced that sustainable income measures are the right ones to concentrate on, they might be persuaded to adjust their policies accordingly. There is no evidence to date that this has happened, but it is early days, and the process has been very instructive.

Finally what are the implications of all these developments for the agricultural sector in African countries? Degradation in the natural resource base is of immense importance to this sector and proper accounting for it is bound to be of crucial help. This applies to both the physical and monetary measures described above. By themselves they are, of course, not going to be sufficient, and nor are they going to provide all the information relevant to a sustainable use policy. For example it does not indicate the 'user cost associated with the use of renewable resources such as forestry and fisheries. Nevertheless they are key elements on the planning side and need to be pursued vigorously.

SECTION VI

CONCLUSIONS

"I leave it to those more qualified to decide what can be expected from above, that is from what is happening in the sphere of power. I have always been more interested in what was happening below, what could be won there, and what could be defended there ... Something is happening in the social awareness, though it still is an undercurrent as yet". It is in the social movements from below that our hope in the deepest and most powerful sense lies. Such hope is not the same "as joy that things are going well ... but rather an ability to work for something because it is good ... It is also this hope, above all, which gives us the strength to live and to continually try new things even in condition that seem as hopeless as ours do, here and now."

President Vaclav Havel
President of the Czech Republic

This document has attempted to provide a consistent analysis of what constitutes sustainable development and sustainable agricultural development and how it can be brought about by appropriate economic, legal and social policies. Rather than providing a detailed analysis of each sector it has given a broad analysis of how decisions should be made and the framework within which they should be made. Each Section has its own conclusions and recommendations. This part will not attempt to conclude, but will serve more as a summary.

Interactions between environmental, population and poverty factors are worth noting Owing to population pressure and the lack of employment opportunities, the poor are often forced into farming marginal or degraded land which cannot sustain them adequately. Poor environment thus contributes to their poverty. Especially with their larger families, the poor have few alternatives but to overgraze grasslands, misuse what agrochemicals they can get, deplete timber reserves and over-exploit water and soil resources. While their efforts permit short term survival, an important and understandable goal, they also lead to environmental degradation, insecurity about

food and increased longer-term poverty. Thus poverty and population growth contribute to further environmental degradation. In some cases, specific incentives may be required to encourage the rural or urban poor to move out of dangerous or degraded environments.

The World Commission on Environment and Development defined Sustainable Development as "*development that meets the needs for the present without compromising the ability of future generations to meet their own needs*". This definition, brings out the notion that the process of improving present living standards should not be at the expense of the living standards of the future which is something few would disagree with. As with most concepts, however, it is not the broad term that is most informative but its operational content. The latter is encapsulated in three working rules or policies that are essential if such development is to be achieved. One is to do with equity. A declining and degraded natural resource base is more likely to result if the interests and needs of the poorest sections of poor societies are not satisfied. Hence Sustainable Development requires, "help for the very poor because they are left with no option other than to destroy their environment". A second working definition is that of resilience, or the capacity of a system to maintain its structure and patterns of behaviour in the face of external disturbance. This requires an ability to adapt to stresses and shocks and is of particular relevance to agriculture. A third working rule is based on the notion of efficiency in the use of resources. Sustainable Development also requires and efficient use of existing natural resources in the sense that the greatest value must be obtained from any given input.

In pursuit of these three objectives the paper outlines three broad areas of action.

The first is to value resources correctly. Such valuations should include all the services performed by them, including those that are not, do not have any cash flows associated with them or that do not pass through any organised market. The valuation process draws on a scientific and socioeconomic database, and in turn feeds into two activities: pricing and investment analysis. On the pricing side it allows decisions on pricing, taxation and subsidies and other instruments to be taken in a more rational manner. On the investment side it feeds into the project appraisal activities that determine how capital funds are allocated between development

activities, and between development activities and others related to environmental protection and conservation.

Secondly, the right economic valuations are necessary but they are not sufficient to ensure Sustainable Development. In addition the appropriate legal and social framework has to be in place. This second broad area for a policy framework requires a careful evaluation of how and why existing systems have evolved and what the direct and indirect impacts of attempting them might be. The economic and the social and legal policies need to act together to ensure a more sustainable resource use.

A third area that is related to the first is that of environmental accounting. Adjusting national accounts to derive a measure of sustainable income could be a useful policy tool to guide macroeconomic decisions. In addition to monetary valuations, environmental accounting looks at the physical stocks of resources and their movement over time. These can be used as part of the set of sustainability indicators, picking up the issues that valuations of resources do not (and cannot) always address.

In the Second Section, the paper has examined four agro-ecosystems to illustrate the issues described above. These are pastoral systems, tropical forestry systems, irrigated agriculture and marginal lands. One conclusion is that such systems have substantial interlinkages, with changes in one area having repercussions in many others. Policies for sustainable agriculture have to be aware of such interlinkages. A second conclusion is that the actions that exacerbate unsustainable use are often government policies that are either misconceived, or carried out for other reasons. Correcting these would take one a long way towards sustainable use. However, such corrections are not enough and if further progress is to be made a range of reforms are necessary. These include devising better rules for the allocation of investment resources, better methods for evaluating environmental impacts in the context of defining regulation on land use, and better fiscal incentives for farmers to take sustainable actions. They also include reforms to the legal and social framework. This is the third conclusion. Finally although one can speak usefully in generalities, the actual policies and instruments will vary from one situation to another. Recognising and understanding local conditions and socio-economic circumstances is critical to the success of any policy reforms.

The design of reforms is dependent on proper valuation of environmental benefits and the Third Section of the paper reviews briefly the techniques available for such valuation. Most current valuation in developing countries is based on indirect valuation methods where no direct account is taken of personal preferences. It concludes that here is considerable scope of extending direct techniques in these countries and indeed some work has begun to use willingness to pay measures in the areas of water supply, sanitation and fuelwood. Existing indirect techniques will, however remain very important and need to be strengthened by improving the scientific and socioeconomic databases, as well as by underpinning them with behaviourial models where possible. Even with all these changes, some impacts will not be able to be valued in money terms, and these need to be documented and acted upon.

Environmental valuation feeds into investment appraisal. Section Three of the paper considers how project appraisal techniques might incorporate such costs and benefits. It concludes that conventional criteria for decision-making need to be modified to include a sustainability criterion. This will apply when environmental damage cannot be valued and when the application of conventional discounting results in the decision that key resources do not need to be protected or rehabilitated. In those cases a constraint that, in overall terms, a compensatory set of projects be carried out to ensure non-degradation of the resource base, should be applied.

Section Four examines the economic, social and legal policies that would be necessary for Sustainable Development. On the economic front it distinguishes between macroeconomic policies that impinge indirectly on the natural resource base, and microeconomic policies that have a direct bearing on it. The latter include both input and output prices for agriculture, as well as special instruments designed to correct the effects of market failure, such as taxes and permits.

Much of the unsustainability derives from government policy failures: macroeconomic policies such as export taxes and overvalued exchange rates, and microeconomic policies such as underpricing of inputs and overpricing of unsuitable outputs. Correcting these is at the heart of policy reform for Sustainable Agriculture. But it has to be recognised that reform in these areas is not easy - there are often complex social and political reasons why things are as they are. As far as the use of direct instruments for environmental protection is concerned, there is little experience

of these in the agricultural systems in developing countries. This should not be seen as a drawback for considering them - after all they are often only just being adopted in developed countries. On the legal and social reforms the paper notes the complexities of the issues and the fact that the design package is certain to be very location specific, with what works in one place not working in another. Further inputs from the legal quarter are expected here.

Section Five addresses the question of environmental accounting. Many of the corrections to the conventional national accounts consist of adjusting for soil erosion, deforestation and loss of exhaustible resources. The correct income measures are useful and may influence decision-makers although the extent to which they will do so is not clear. The exercise is of some benefit in its own right as it provides a stimulus for a systematic evaluation of the countries natural resource base. The same applies to the physical accounts which have the additional advantage of helping in the derivation of a set of sustainability indicators, which can be of value in making the sustainability criterion operational. The system of Accounting being introduced does not indicate the user cost associated with the use of renewable resources such as forestry and fisheries. But the ongoing developments need to be pursued vigorously.

NOTES

1. World Commission on Environment and Development, 'Our Common Future', (London, Oxford University Press, 1987).

2. In Pearce, Markandya and Barbier there is a survey of definitions of Sustainable Development, and about 24 are judged as worthy of inclusion. Of course there is some overlap, and they operate in different contexts and paradigms, but it does indicate a proliferation that needs to be reduced. D. Pearce, A. Markandya and E. Barbier, Blueprint for a Green Economy (London, Earthscan Publications, 1989).

3. In fact it is included in the definition of Sustainable Development of Goodland and Ledec which states, "*Sustainable Development is a pattern of social and structural economic transformations (i.e. development) which optimizes the economic and other societal benefits available in the present without jeopardizing the likely potential for similar benefits in the future*", from FAO, 'The State of Food and Agriculture 1989', Rome, (author's emphasis).

4. Such models have been surveyed by R. Solow, 'On the Intergenerational Allocation of Natural Resources', Scandinavian Journal of Economics, 88, pp. 141-149 (1986). The arguments have recently been taken further in K.G. Maler, 'Sustainable Development', mimeo. The World Bank (1989) and E. Barbier and A. Markandya, 'The Conditions for Achieving Environmentally Sustainable Development', European Economic Review (1990). The term 'development' here incidentally is more general than just economic growth and should not be confused with the latter. For details on the distinction as it applies in this case see Pearce, Markandya and Barbier (1989 op. cit).

5. The term pricing is used here to cover all fiscal instruments that might be employed to influence the pattern and level of use of a particular resource. These could include taxes, subsidies, permits etc. They are discussed further in Section III.

6. For a recent review of the debate about dryland degradation see, S.W. Bie, 'Dryland Degradation Measurement Techniques'. The World Bank, Environment Department, Washington D.C. 1990. Estimates of carrying capacity of rangelands vary by factors of 4-5.

7. World Resources Institute, 'World Resources 1988-89', (Basic Books, New York (1989).

8. Adapted from D. Pearce, 'Economic Values and Tropical Forests', mimeo, University College London, 1990.

9. See H. Binswanger, 'Brazilian Policies that Discourage Deforestation in the Amazon', World Bank, Environment Department Working Paper No. 16, 1989; D. Mahar, 'Government Policies and Deforestation in Brazil's Amazon', World Bank, Washington D.C., 1989; M. Gillis, 'Indonesia: Public Policies, Resource Management and the Tropical Forest' and 'Malaysia: Public Policies and the Tropical Forest', in R. Repetto and M. Gillis (eds.) Public Policies and the Tropical Forest, (Cambridge, CUP, 1988).

10. Sedimentation is estimated to be a major problem in irrigation reservoirs throughout the developing world. Brown and Wolf in a survey of Indian reservoirs have found that the estimated actual life of such reservoirs range from 6 per cent to 68 per cent of their design life. L. Brown and E. Wolf, 'Soil Erosion - Quiet Crises in the World Economy', Wolfwatch Institute Paper 60 (Washington D.C. 1984). Various World Bank studies support these findings.

11. Taken from G.R. Conway and E.B. Barbier, 'After the Green Revolution', Earthscan Publications, 1990.

12. Cropland expansion from UN Food and Agriculture Organization (FAO) (1992), *Production Yearbook 1991*, Rome; figure of 76 million from "Crops from Pasture Land", *International Agricultural Development*, March/April 1993, and from Thomas, R.J. (1993), Centro Internacional de Agricultura Tropical, Cali, Colombia, private communication, July 21.

13. Fish catch from FAO, Fisheries Department, "Global Fish and Shellfish Production in 1991", COFI Support Document: Fishery Statistics (March 1993), Rome; percentage of human protein consumption from FAO, *Food Balance Sheets* (1991), Rome; contribution to coastal diet from FAO (1993), "Marine Fisheries and the Law of the Sea: A Decade of Change", *Fisheries Circular* No. 853, Rome.

14. Fivefold increase in world fish catch from FAO (various years), *Yearbook of Fishery Statistics: Catches and Landings*, Rome; other figures from Perotti, M., chief, Statistics Branch, Fisheries Department FAO, Rome, private communication, November 3, 1993.

15. Advent of fisheries technologies and assessment of all fishing areas from FAO, "Marine Fisheries and the Law of the Sea", op.cit. note 9; FAO (1993), "World Review of High Seas and Highly migratory Fish Species and Straddling Stocks", *FAO Fisheries Circular* No. 858 (preliminary version), Rome.

16. Estimate of potential catch from FAO-sponsored book by Gulland, J.A. (ed.)(1971), *The Fish Resources of the Ocean*, Fishing New (Books) Ltd., West By fleet, Survey, U.K.; 2010 projection is Worldwatch Institute estimate, based on data from FAO, "Marine Fisheries and the Law of the Sea", op.cit. note 9.

17. The 1700 figure does not include woodlands or shrublands, from Houghton, R.A., et al. (September 1983): "Changes in the Carbon Content of Terrestrial Biota and Soils Between 1860 and 1980: A Net Release of CO_2 to the Atmosphere", *Ecological Monographs*. FAO and the UN Economic Commission for Europe/FAO (UNECE/FAO) used somewhat different definitions in their 1990 forest assessments, which precludes a strict comparison of the data between tropical and temperate zones when calculating the change in world forest cover between 1980 and 1990. For both regions, "other wooded areas" have been excluded from all calculations. Because of gaps and discrepancies in the data, FAO does not plan to make any estimate of global deforestation at the conclusion of the 1990 assessment (in progress as of October 1993), according to Klaus Janz, senior forestry officer, Resources Appraisal and Monitoring, Forestry Department, FAO, Rome, private communication, October 29, 1993. The estimated net loss of forests refers to the conversion of forests to an alternative land use, minus the net addition of plantations in tropical regions. As defined by FAO, loss of forests does not include forest that was logged and left to regrow, even if it was clear-cut (unless the forest cover is permanently reduced to less than 10 per cent). Thus, the statistics fail to reflect the fragmentation or degradation of forests.

Given these limitations, the 1990 figure is a preliminary and rough Worldwatch Institute estimate, based on: FAO (1993), *1961-1991 ... 2010: Forestry Statistics Today for Tomorrow*, Rome; FAO (1988), "Areas of Woody Vegetation at End 1980 for Developing and Developed Countries and Territories by Region", Table 1, in *An Interim Report on the State of Forest Resources in the Developing Countries*, Rome; all tropical countries from FAO (1993), *Forest Resources Assessment 1990 - Tropical Countries*, Forestry Paper No. 112, Rome; Australia, Europe, Japan, and New Zealand from UNECE/FAO (1992), *The Forest Resources of the Temperate Zones: the UNECE/FAO 1990 Forest Resource Assessment, Vol. 1: General Forest Resource Information*, United Nations, New York; Canada from Canadian Council of Forest Ministers (1993), *Compendium of Canadian Forestry Statistics 1992*, National Forestry Database, Ottawa; Lowe, J. (November 4, 1993), Forest Inventory and Analysis Project, Petawawa National Forestry Institute, Canadian Forest Service, Chalk River, Ontario, unpublished printout and private communication; United States from USDA, Forest Service (1982), *An Analysis of the Timber Situation in the United States: 1952-2030*, Forest Resource Report No. 23, Washington D.C.; Waddell, K.D. Oswald, and D. Powell (1989), Pacific Northwest Experiment Station, Forest Service, *Forest Statistics of the United States 1987*, Research Bulletin 168, Portland, Oreg.: USDA; Bones, J. (October 22, 1993), branch

chief, Forest Inventory Research and Analysis, Forest Service, USDA, Washington D.C., private communication; former Soviet Union from Shvidenko, A. (July 1-8, 1993), International Institute for Applied Systems Analysis (IIASA), Luxembourg, Austria, unpublished printout and private communication; China from Smil, op.cit note 4; Argentina from The Republic of Argentina, National Commission on the Environment, National Report to the United Nations Conference on Environment and Development, July 1991; rough estimates for the other temperate developing countries based on trends and projections in FAO (1988), Forest Resources Division, *An Interim Report on the State of Forest Resources in the Developing Countries*, Rome, and on Lanly, J.P. (1983), *1980 Forest Resources Assessment*, FAO Rome; area of tropical plantations from FAO, *Forest Resources Assessment 1990 - Tropical Countries*, op.cit in this note. The estimated loss of 148 million hectares of natural forest was offset by the 18-million-hectare gain in tropical plantations to arrive at the figure of 130-million-hectare net loss between circa 1980 and circa 1990.

18. For a more detailed discussion of valuation techniques, see J. Boyo, K-G. Mäler and L. Unemo, 'Environment and Development: An Economic Approach', (AH Dordrecht, Kluwer Academic Publishers, 1990). See also A. Markandya and D. Pearce, 'Environmental Policy Benefits: Monetary Evaluation' (Paris, OECD, 1989).

19. For valuations soil erosion see, J. Bishop and J. Allen, 'The On-Site Costs of Soil Erosion in Mali', World Bank, Environment Department Working Paper No. 21, Washington D.C., 1990; and 'Indonesia: Forest Land and Water: Issues in Sustainable Development', Report No. 7822 - IND, Washington D.C. 1989.

20. For a detailed survey of the relationship between macroeconomic policy and the environment see, A. Markandya and J. Richardson, 'Macroeconomic Adjustment and the Environment', mimeo. University College, London, 1990.

21. The economic theory of production uses the concept of a production function, whereby output is produced from a combination of inputs. A common production function used in growth theory (e.g. Solow, 1991) is $Y = F(K,L,t)$, where Y is output, K is capital inputs, L is labour inputs, t is time (introduced to reflect technical progress) and F(.) is the function which states how the inputs are combined.

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