

**SUSTAINABLE RESOURCE USE
&
SUSTAINABLE DEVELOPMENT:
A CONTRADICTION?!**

by

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Abstract

The concept of 'sustainability' has become the current answer to absolving the world of its environmental and economic crises in the 21st century. Since its conceptualisation, there has been a barrage of investigations and literature on the vagueness and ambiguity of its definition and applicability. There are two main opposing schools of thought - the pessimists, usually ecologists and other scientists, who are convinced the earth cannot forever support the world's demand of renewable and non renewable resources. On the other side are the optimists, the economists, who are equally convinced that the earth, with market incentives, appropriate public policies, material substitution, recycling, and new technology can satisfy the needs and improve the quality of human welfare, of this and following generations, indefinitely. Both views and supporting arguments are explored in the context of sustainable resource use and sustainable development. The complexity of sustainable development is also discussed in the light of international conventions and agreements. Examples of the application of sustainable strategies to local, national and regional issues, as well as the role of international agencies in local/national strategies, are also reviewed to give a glimpse of understanding how initial objectives may succeed, or in spite of all good intention, fail. Both sides of the argument have a point and are seen as two sides of the same coin. With limited empirical evidence of ecosystem evolution and resource maintenance, sustainable resource use is basically dependent on the outcome of the cost-increasing effects of depletion and the cost-reducing effects of new technology. Sustainability is therefore seen as a dynamic concept based on attitude and flexibility not the final solution to utopia on earth.

Acronyms

APTA	Association of Alternative Technology Programmes
BMZ	Bundesministerium für Wirtschaftliche Zusammenarbeit
FEPA	Federal Environmental Protection Agency
FOE	Friends of the Earth
IUCN	Union for Conservation of Nature and Natural Resources
MABR	Mata Atlantica Biosphere Reserve
NCS	National Conservation Strategy
NEAP	National Environmental Action Plan
NGO	Non Governmental Organisation
NRCC	Natural Resources Conservation Council
SD	Sustainable Development
SEAMA	State Department for Environmental Affairs
TFAP	Tropical Forest Action Plan
UNCED	United Nations Conference on Environment and Development
WCS	World Conservation Strategy

Introduction

The word “sustainability” has become a global buzzword as a potential solution for the many international, regional, and local problems facing society today. As developing nations struggle with issues of overpopulation, disease, and political conflict, developed countries also have to deal with problems such as infrastructure deterioration, pollution, and unlimited urban expansion with limited resources. The United Nations World Commission on Environment and Development coined a definition of sustainable development, which is probably the most well-known in all of the sustainability literature: “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WECD, 1987).

According to MSN Encarta (WWW), the word “sustainable” means “able to be maintained”. However, from the number of published books and articles in professional journals, there seem to be many contrasting views and opinions as to exactly what “sustainability” is, if and how it can be achieved or in some cases, whether it is an elusive dream of attaining the so-called ‘heaven on earth’.

The purpose of this paper is to review the relevant and contrasting views on sustainable resource use and sustainable development, with some practical examples of the application of sustainable strategies in a local, national and regional context.

The paper presents a few popular basic concepts of sustainability and its application in natural resource use and development. A brief history is given of the evolving environmental concerns about increasing resource use, as well as a review of the contrasting arguments of the benefits and/or detrimental effects of environmental degradation to human welfare. The complexity of sustainable development is also discussed in the light of international conventions and agreements. Four case studies are finally assessed in the application of sustainable strategies to local, national and regional issues, as well as the role of international agencies in local or national strategies, each with a brief summary of opportunities gained and lessons learnt from initial objectives to practical application of sustainable measures.

The Concept of Sustainability

Sustainability is the process suggested to improve the quality of human life within the limitations of the global environment. It involves solutions for improving human welfare that does not result in degrading the environment or impinging on the well-being of other people. Although there is no general agreement about the precise meaning of sustainability, there seems to be a general consensus that three basic concepts are involved in sustainable measures: living within certain limits of the earth's capacity to maintain life; understanding the interconnections among economy, society, and environment; and maintaining a fair distribution of resources and opportunity for this generation and the next.

In understanding its complexity, one popular framework shows sustainability issues as being classified into three categories: social/political, environmental, and economic issues. These three classes of issues are arranged as vertices of a triangle – depicted as Munasinghe's triangle (Figure 1) – and imply that achieving sustainability involves finding solutions which balance the importance and impacts of each of the three categories (after Munasinghe, 1993, in Pearce, 1999). This provides a good classification system for sustainability properties, and highlights issues such as social and political impacts which have often been omitted from consideration in traditional design processes, or otherwise overshadowed by variables such as time, cost, and quality.

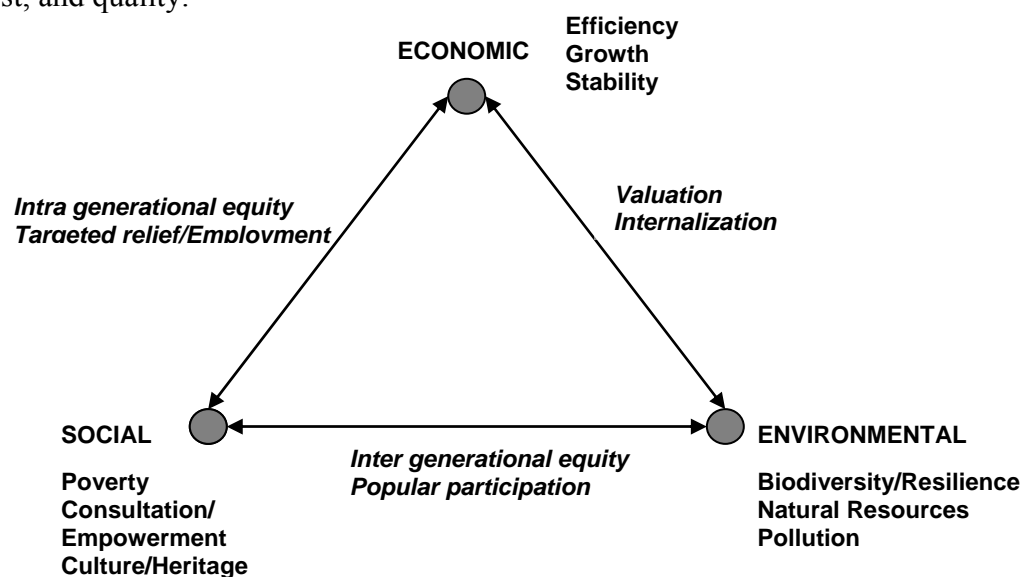


Figure 1: Munasinghe's Approach to Sustainable Development
(Source: Pearce, 1999)

Another model (Figure 2) shows interaction among the three components with a middle 'zone of sustainability' which recognizes the interdependence of biological economic

and social systems (Spies, 2003). In business, this notion of three integrated aspects is sometimes called the ‘Triple Bottom Line’—increasing profits, improving the planet and improving the lives of people.

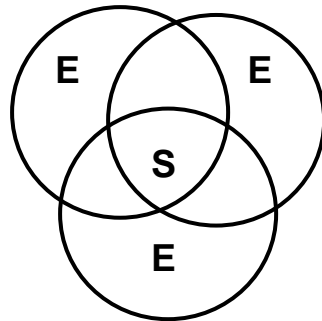


Figure 2: The interaction of the three E’s (Economy, Environment, and Equity), with a middle zone of sustainability (S).

A redefined concept is of the community as whole system, made up of three concentric circles: the economy is found within society, and both the economy and society exist within the environment. Sustainability indicators are therefore said to attempt to measure the extent to which these boundaries are respected.

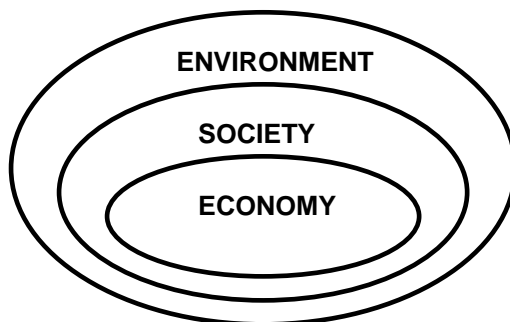


Figure 3: Sustainability Measures as a whole concept
(Source: Hart Environmental Data, www.sustainablemeasures.com)

A different framework was proposed by the economist Herman Daly who rearranged sustainability into a triangular setup of the 3E’s – *Environment*, *Equity* and *Economy* (Figure 4.) At the bottom of the triangle is the *Environment* or the ‘Ultimate Means’ which represents natural resources as a precondition for decent human life. The *Economy* (which includes technology, politics and ethics) is on the next rung, is not independent but serves as a vehicle for achieving ultimate ends. At the top is *Equity*, or the ‘Ultimate End’ which refers to the wellbeing of the human being. According to Daly, the economy therefore succeeds to the extent that it conserves and restores ultimate means (the environment), and enables the achievement of ultimate ends (equity) (Daly, 1990).

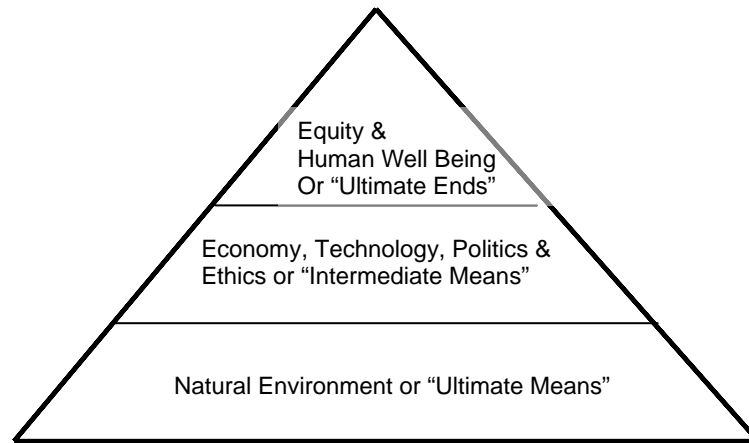


Figure 4: Daly's Triangle of Equity, Economy and Environment
 (Source: www.sustainablesonoma.org/keyconcepts/dalystriangle.html)

Becker (2002) also suggests that the term sustainability is another side of the coin of competitiveness, and provides some form of organization. Sustainability is the acknowledgment of the various environmental and cultural diversities which could be transformed into advantages at different geographical scales. Here, sustainability is seen as the optimisation of natural alternatives that each local, region or nation has (through their individual cultural and environmental differences) in the process of development.

Resource Use and Sustainability

Resources are the backbone of every economy and provide two basic functions – raw materials for production of goods and services, and environmental services. A common classification of natural resources is as follows (de Zeeuw, 2000, *in* EC-DG Environment, 2002):

- Non renewable and non recyclable resources such as fossil fuels
- Non renewable but recyclable resources, such as minerals
- Quickly renewable resources such as fish
- Slowly renewable resources such as forests
- Environmental resources, such as air, water and soil
- Flow resources, such as solar and wind energy

The issue of depletion plays an important role in the use of non renewable and renewable natural resources. In the renewable resources depletion occurs when extraction exceeds renewal rate. Environmental services include the sink function which assimilates and recycles waste products from production and consumption. Flow and environmental resources are not depleted and always exist. However, environmental resources can be degraded by pollution, and rendered useless.

Resource Use and Environmental Concerns

Throughout history, resources have been found in abundance, depleted and substituted with others, often with new technology and development strategies. As societies became more complex with trading systems, natural resource surpluses were converted into financial and infrastructural wealth. Ruttan (1993) summarises that there were three waves of concern about resources and the environment. In the late 1940s and early 1950s, was the initial concern of “quantitative relationships between resource availability and economic development” which resulted in technical progress to increase rates of production. By the late 1960s and early 1970s, was the awareness that scarce natural resources led to limits in growth as well as the concern about the capacity of the environment to recycle pollution derived from growth. This led to a serious conflict of interests in the demand for environmental services. On one hand was the concern about the capacity of the ecosystem to process the pollution created by commodity production and consumption, and the other was the increase in consumer demand for environmental amenities as a result of rapid growth in per capita income.

Ecologists view natural systems as assets that serve as reservoirs of energy and materials and have been concerned about the resilience of these systems to recover following stress or intervention. Economists concentrate on the market and see that environmental quality has not been included in market transactions and thus been undervalued and underprovided. Their solution is basically to seek better methods of evaluation for environmental amenities (Howarth and Nogaard 1992, in Erekson, 1999).

In 1972, the Club of Rome published a report called “Limits to Growth”, which drew worldwide attention to the limits of resources and an inevitable collapse of all life on earth if the current rate of resource depletion was not changed. This led to Ruttan’s “third wave of concern” of the mid-1980s which was about the implications of serious global environmental changes on environmental quality, food production, and human health for this and the next generations. The Club of Rome’s report was however disputed for a number of reasons. One was that the current reserves of resources were found to be much larger than was estimated, mostly due to advances in technology which improved and increased access to these resources. Secondly the use of resources did not grow as much as was predicted due to increasing resource efficiency, development of substitutes and increased levels of recycling.

Weak and Strong Sustainability

Another argument has been that in using resources and transforming them, capital stocks are built which add to the wealth of present and future generations. Some economists argue that there is an important positive relationship between economic growth and measures of environmental quality. This has led to the concept of ‘weak’ and ‘strong’ sustainability which refers to the degree to which man made and natural forms of capital can be substituted for one another (e.g. Turner, 1992). In ‘weak’ sustainability there is a high degree of substitution - although as the resource becomes scarce, the benefits of its further use would have to be greater to justify the use. This concept is based on the fact that during the stages of early development, resources are exploited, the environment is degraded, and income increases. At a critical point however, environmental quality begins to improve as the now higher-income society restores the environmental impacts of the early stages of economic development. This relationship has been simply depicted by Erekson, Loucks & Stafford (1999) (Figure 5a) and recently reviewed as a Prototype Environmental Kuznet’s Curve by Yandle, Bhattarai & Vijayaraghavan (adapted from Rogders, 2004) (Figure 5b). The assumption is that man made capital used in the early stages of development increases human knowledge and technology such that there is an optimal substitution of resources which leads to ‘sustainable’ economic growth. Concerns about irreversible loss of resources such as biodiversity or global warming, are pacified with the potential of new technologies which will lead to greater investments to the future generations for alternative resources and welfare (Erekson *et al.*, 1999).

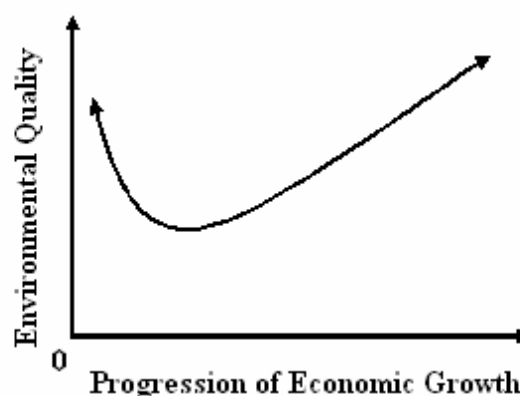


Figure 5a: The long term relationship between environmental and economy growth
(Source: Erekson *et al.*, 1999)

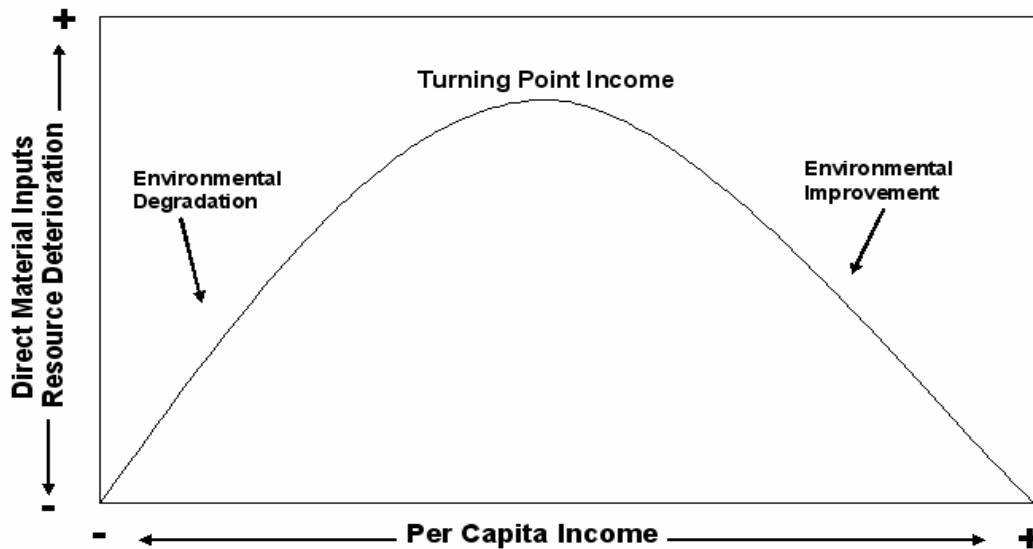


Figure 5b: Yandle, Bhattarai & Vijayaraghavan Prototype Environmental Kuznet's Curve (Source: adapted from Rodgers, 2004)

Strong sustainability is the opposing view that assumes that the two forms of resources are complementary and *not* substitutes of each other. It argues that it is not possible to have unlimited substitution between natural and man made capital and that there is the need to maintain critical levels of environmental services. Small stocks of natural capital, for example in fisheries and old forests, are actually limiting factors in present economic development (Folke *et al*, 1994 in Erekson 1999). Another argument is that as the earth is of a definite size and exceeding the capacity of the earth to assimilate and recycle waste affects availability of nature's functions and resources. These researchers still remain unconvinced since the evidence in support of economic growth leading to environmental improvements are based on short term studies which do not take into consideration delayed or intergenerational feedbacks.

Considering both sides of the issue, Erekson *et al.* (1999 p. 17) suggest that sustainability should be seen as “a system whereby economic growth and/or improvements in the quality of life occur in a unified system that is complementary with, rather than antagonistic to, natural capital”. It is an agreement to build consensus among political institutions, industries and population towards a dialogue with the stakeholders that represent these subsystems and “the result should be a unified system able to maintain a dynamic equilibrium and able to regenerate itself to maintain its viability” (p.19).

Resource Use and the Future

The Bruntland Commission's definition of sustainability to not preventing future generations from having the same sort of share of the resources and opportunities- or intergenerational equity - has also led to disagreeing opinions. Kenny's (2004) simple summary of one school of thought is to question exactly how one would reconcile the issue of intergenerational equity when exploiting non renewable resources, for example. In his opinion, although it is currently not known when energy resources will become uneconomic for exploitation; it is only common sense that at *any* fraction of use of the resources, only a small percentage of the original amount will be available for future generations – contradicting the whole concept of equity.

The other side of the argument of resource availability and economic scarcity is recapitulated by Tilton (2001) in his example of the decline of the supply of whale oil as many species of whales were hunted almost to extinction, in the early 1960's. The development of low-cost petroleum products and electricity, replaced the needs for whale oil, and therefore prevented this physical decline from producing economic scarcity. Examining the period between 1870 and 1957, Barnett and Morse (1963) found that both renewable and non-renewable resources (particularly non-renewable mineral resources), became *more* and not less. As a result of new technologies which lowered the costs of finding new resources, allowed the exploitation of previously known but uneconomic resources, led to substitution of less scarce resources for more scarce resources and reduced the amount of resources needed to produce final goods and services.

This on-going argument is a result of the different hypotheses that each side uses (Tilton 1996, in Tilton, 1991). Although conceding with the advantages of technological advances, the environmentalists believe that falling production costs, and rising environmental costs associated with resource depletion have not been included. Tilton (1991) suggests that there is currently a hybrid of both schools of thought which agrees with abandoning the “fixed stock paradigm” and rather focussing on the “opportunity costs of finding and extracting mineral resources”. According to Tilton, the opportunity cost paradigm says that with increasing prices, demand continues to fall such that at zero, production will stop with some level of the non-renewable resources remaining (e.g. minerals). Economic depletion therefore occurs before physical depletion becomes an issue. In addition, higher prices strengthen the economic incentives to develop new cost saving technology, to discover new deposits, to recycle obsolete mineral commodities, and to find

less-costly substitutes. Such self-correcting mechanisms, they believe, make the economy much more resilient to the threat of depletion than many suppose.

Even with increase in population, this may lead to more good minds to create better technology. As Gregori (1987, p. 1243, 1247) points out, “humans are the active agent, having ideas that they use to transform the environment for human purposes....Resources are not fixed and finite, because they are not natural. They are a product of human ingenuity resulting from the creation of technology and science”. Simply put, natural resources do not exist independent of man and are not materials that are found and exploited like buried treasure. They are created by mankind.

The pessimists on the other hand are well aware that these forces, and in particular new technology, have in the past kept mineral costs and prices from rising. Their concern, however, is for the future. They see the demand for mineral commodities rising rapidly, and question the wisdom of assuming that market incentives and new technology can indefinitely keep mineral scarcity in check. New technology for them is a two-edge sword, to be viewed with some suspicion. While being beneficial (such as lower-cost mineral commodities), it also creates serious problems (such as global warming and loss of biodiversity). Future trends in resource availability will therefore depend largely on the outcome of the cost-increasing effects of depletion and the cost-reducing effects of new technology.

Development and Sustainability

The issue of development can be presented as “... a generic approach, development theories, even though (neo) liberal or Marxist ones, inspired by the occidental societies in order to propose models to the whole world. The principal idea of development that justifies this vision is “the occidental humanist paradigm”; based on the comprehension that social economic development is produced by the technical scientific advances that assure the growth and progress of the human virtues, the liberties and the power of the men. What seems to emerge as supreme truth from this development vision would be synthesized as: technical scientific development → social economic development → progress and growth” (Almeida, 2002, p.22). Thus, “the idea of development continues tragically underdeveloped because it is still tied to the economic rationality” (Morin & Kern, 1995, p.74, in Becker, 2002, p.14).

Moreover, according to Almeida (2002), the idea of development is diminished in comparison to modernization. As a consequence of that, the third world countries are judged

under the pattern of developed countries, and all of them coming from previous modernization. This kind of ethnocentrism has conducted to the application in the entire world of a unique model of modernization, and therefore to relate the underdeveloped countries as “the lateness”. In fact, the frontier between development and modernization seems to be not so clear. While the first one refers to the different social actors’ will in transforming their society, the other points out the capacity of a social system in producing the modernity.

Furthermore, Kirkby *et al.* (1995) noticed that although many attempts have been made through aid programmes, especially since the end of the Second World War to fulfil development in the South, it is obvious that relatively little has been achieved. It is the so-called “crisis of development”. In this same way, they also mentioned “the environmental crisis”, which is supported by the perception that while population rises by 100 million a year, the earth’s capacity to support humankind is reduced. This is what Erekson *et al.* (1999) call “carrying capacity”, a concept that grew out of the biological foundations of population ecology about 70 to 80 years ago. In addition, Kirkby *et al.* (1995), pointed out the “the crisis of global insecurity” as the third and probably most serious menace to development. The wars or trade wars have happened and probably increased as new causes of conflict may emerge in the future for the control of oil or water supplies.

Concerning those evidences above, there is a possibility to think about a new mode of development or social organization, which would be based on a cultural, social, economic and environmental sustainable development. The conception of sustainable development arises from the understanding that natural resources are not infinite and also from the comprehension about the development model, which brought so many social differences everywhere in the world along the last decades. The recognition of the actual unsustainability of the development patterns of the coeval society made feasible to build a new idea about a sustainable development. Although this new notion has been thought and hard working, it is still general, prolix, and it has little exactness.

In 1992, the United Nations General Assembly asked for a report back on progress in sustainability, known as Rio-92 or United Nations Conference on Environment and Development (UNCED). The differences between Brundtland and *Rio-92* agendas are presented in Table 1. According to Kirkby *et al.* (1995), “... this change in agenda was not simply because the lawyers had taken over but because the sustainable debate had been driven by Northern governments, using Northern environmental NGOs such as Friends of the Earth (FOE) and Greenpeace to pursue a status quo development framework that was

essentially against the South. The North turned ‘green’ and the South was turned away”.

Table 1: The Synthesis of Agendas

<u>BRUNDTLAND</u>	<u>RIO-92</u>
Threatened future	Conventions on climate change
Sustainable Development	Forests
International Economy	Biodiversity, biotechnology, land resources
Population and human resources	Hazardous wastes
Food security	Toxic chemicals
Energy	Freshwater
Industry	
Urbanization	Action for SD into the 21 st Twenty-First Century
The commons	Environmental awareness
Conflict-environment and development	Poverty and environment
Proposals for institutional and legal change	Finance
	Agenda 21-Cross sectoral issues
	The Earth Charter

Source: Middleton et al. (1993), in Kirkby et al. (1995)

The final outcome from *Rio-92* conference was better than was feared during the meeting itself, although the primordially different priorities of the Northern states demanding environmental sustainability and the Southern states demanding development, ensured that agreements will be reached only with hard work. The outcomes of *Rio-92* were;

- a) Convention on Biological Diversity;
- b) Framework Convention on Climatic Change;
- c) Principles of Forest Management;
- d) Agenda 21 and
- e) The Rio Declaration on Environment and Development,

It is worth observing that the Agenda 21 is a large document and may be considered as an action plan for SD and/or a manual of good practice for SD. Within this document, four groups of topics were considered: 1. Social and economic development; 2. Resource management; 3. Strengthening the participation of major groups and 4. Means of implementation (Kirkby *et al.*, 1995).

According to Almeida (2002), there seems to be a dichotomy between the ideas of SD, as it is presented within an economic sphere and based on this view, the social level could be figured out. Concerning this manner, nature is somehow shared in the production system (the nature is seen as a capital asset). On the other hand, there is the notion, which tries to break down the hegemony of the economic discuss, and goes further the instrumental and restrict vision that economy imposes to this idea. Although many efforts have been made

in order to construct this new concept, what happens in fact is that there is no consensus among the different actors and economical agents involved in this process and the definition, which is the most accepted by the majority is the one pointed out in the *Brundtland Report* (1987).

Unfortunately, there is also no agreement about the economical growth path, which should be followed in order to achieve SD. As suggested by some authors, whether analyzed under the environmental criteria, as the utilization of non-renewable resources and pollution, the countries from the south hemisphere would be considered nearer to sustainability (Ruttan, 1993).

The “economic” conception of SD points out to new mechanisms of market as a solution to stipulate the production to support the capacity of natural resources. The consideration here is to extend the mercantile regulation over the nature, pushing the social struggle for the control of the natural resources into the market, and not through the political sphere. It is passed over the conflict for the control of the natural resources, trying to create special conditions to keep them, without considering the political social standings, which rule the control power and the use of those resources. Otherwise, there is a group, which proposes a SD that guarantees the democratic diversity. The ones who defend this position, believe even though the mechanisms of SD could be able to minimize the impact of production and consumption over the natural resources, they are only mechanisms built within an economic rationality, which should be at first submitted to the political decisions of the societies. The alternatives to the future are choices that must take place fundamentally in the political field. The solution for the environmental crisis would come through the democratization of the control of the natural resources and through the non-privatization of the usual environment (Almeida, 2002).

Nevertheless, the debate about the types of development and the quality of the natural systems is going on since the *Brundtland Report*, independently of its content or political statements. After two decades of discussion, the environmental issue is introduced in the debates about economic politics, international relations and other fields. The concern now is how to achieve a new style of development, in which the environmental issue is present. It is necessary to recognize new forms of organization and requirements, which could establish and lead to a reliable sustainability. The kind of model we could imagine is the one that brings alternatives altogether able to face new solutions to this social and environmental crisis (Figure 6.).

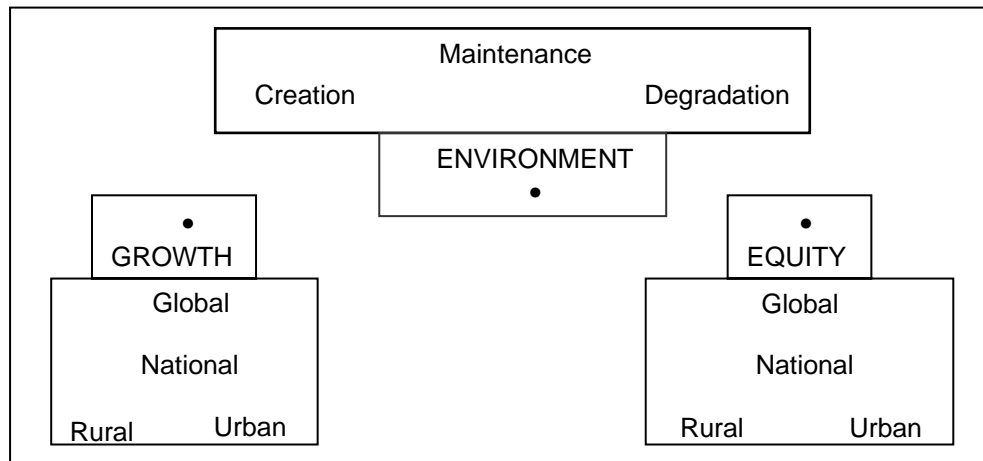


Figure 6: The complexity of sustainable development (*Source: Kirkby et al., 1995*)

Goodland and Ledec (1987) point out the social system components by defining SD as “a pattern of social and structural economic transformations (i.e. development) which optimizes the economic and societal benefits available in the present, without jeopardizing the potential for similar benefits in the future”. Through this definition, the SD could be a scientific and a social concept, more often regional, national or even international, as the complete definition should consider different scales as well.

Much of the information in Agenda 21 and similar documents suggest that sustainable development is a globally managed interdependence – with international development agencies defining the appropriate development strategies for regions in the south, while regions in the north benefit from the south’s sale of cheaper goods and natural resources. Economically driven globalisation is not compatible with sustainable development because multinational corporations and elite groups are more concerned with increasing their own profits than establishing a stewardship for the environment. Unfortunately it is those corporations that have the financial, political and social power to influence national and international decisions on environmental policies. Sustainable development should therefore come from a grassroots, community based, self-reliant approach, which also integrates the top-down and bottom-up strategies for maintaining a balance.

Sustainable Development Projects

The following discussion is an analysis of four case studies and lessons learnt in the different approaches of ‘sustainability’ – in local (Alto Bayano river basin), national (Botswana government) and regional (Brazil) strategies. The final case study of Nigeria’s national strategy shows the effects of international involvement in a national or local strategy

and lessons learnt. The sustainable development strategy also includes areas of economic development, social development and environmental and conservational development in its analysis and policy formulation (Ornat, 1997).

Alto Bayano River Basin – Latin America

The Alto Bayano had been affected by colonization and deforestation since the 1970s. It covers an area of 350000 ha and is the largest hydroelectric basin in Panama. Many efforts had been made to solve threats caused to the function of the hydro dam, mainly by inter-ethnic confrontations and environmental degradation. In 1985, an official commission (the Bayano Commission), composed of national institutions, local communities and the private sector, was set up to protect the basin. Later in 1990, The Tropical Forest Action Plan (TFAP) started a regional strategy, but little progress was made because of many problems caused by the ethnical conflicts. Towards the end of 1993, a management plan for the basin was prepared and the process began with the financial support of Bundesministerium für Wirtschaftliche Zusammenarbeit (BMZ, Germany) and technical assistance provided by World Conservation Union (IUCN). In 1994, there was a change in government who had an improved approach of providing economic alternatives to the immediate problems indicated by the communities. The peasants were encouraged to interact and for the first time in the community, the indigenous people asked to participate in the project. Initially, the objectives of the project were to manage and protect the basin by solving the interethnic problem and halting deforestation. With the strategy, it evolved into: the protection of the basin, its ecological function and its water regulation capacity; provision of sustainable development for local communities; preservation of the characteristic biodiversity of the area; resolution of inter-ethnic problems (indigenous groups and settlers) and provision of alternatives to the local population sustainable production (Batista & Lopez, 1997).

From the beginning, the sustainable development strategy proposed for the Bayano River Basin was affected by the political environment, poor governmental support and limited participation by the communities. At the end opportunities like emphasizing the basin's hydrological function as a national asset and the integration of the strategy within the TFAP and international organizations, were realised. Importantly were lessons about programme objectives being politically viable, flexibility of objectives to incorporate variability of situations, and the direct involvement of communities.

Botswana – Southern Africa

On a national level, the government of Botswana government recognized the need for a National Conservation Strategy (NCS) in 1983. The NCS was related to land degradation, rangeland degradation, wildlife depletion of wood resources and veld products as well as water resources. Their main concern was that the qualities of these resources were being dangerously reduced such that they would not be sufficient enough to support future economic development. The government applied for technical assistance from International Union for Conservation of Nature and Natural Resources (IUCN) and other European agencies. Their objectives were to reduce environmental degradation, increase the effectiveness with which natural resources are used and managed, integrate the work of the various sectoral ministries and interest groups in Botswana, and increase the education and participation of all members of society, amongst others. (Monna, 1997).

According to the authors, in preparing for the NCS, there was an initial phase of developing an efficient policy framework which also identified the institutional and legislative measures for its successful implementation. This led to the preparation of an Action Plan which was to enable in the formulation and monitoring of the implementation stage. The NCS document was approved in 1990 and set up as an Agency with institutional linkages with the central and local governments. These institutional linkages are the main means by which coordination and implementation of the NCS were achieved. Its main strengths were in the comprehensive review of the legislative framework that showed what changes were required to improve the country's environmental laws, and the extent of involvement of the institutions in the strategy. Another positive aspect of the strategy is that education and persuasion were used rather than penalties for environmental offences. The main limitations to the NCS process were due to insufficient local skills and personnel to facilitate the process; a lack of clearly defined authority and an inadequate institutional framework; an unclear and ill-defined prioritization of issues and subsequent actions. From this example, it can be concluded that it is important to promote greater public awareness in order to succeed and that well defined legislation and cooperation between capable institutions are required before such a programme can be implemented.

Brazil – Latin America

On a much larger and regional scale, a strategy for sustainability was the Mata Atlantica (Atlantic Forest Region) Biosphere Reserve (MABR) programme in Brazil. This programme involved 14 federal states and federal government organizations as well as the

Association of Alternative Technology Programmes (APTA), a peasant exchange training network operating in six States (Rio Grande do Sul, Santa Catarina, Parana, Rio de Janeiro, Espirito Santo and Ceara). The programme, coordinated by the State Department for Environmental Affairs (SEAMA) was located in Espirito Santo State which has 36% of the Mata Atlantica biosphere reserve. The area suffers from severe structural and agricultural development problems resulting from the “green revolution” policies and from the cultivation of eucalyptus to produce cellulose (Salles de Sa *et al.*, 1997).

The main objective of the programme is to reverse the deterioration of the remaining five percent of the original sub tropic forests – which makes it one of the worlds most threatened ecosystem – and turn it into a 4,000 km long biological corridor. A second social object was to improve the region’s economic conditions and local standards of living. APTA’s additional objectives were to promote agricultural production by local and ecologically sustainable techniques.

The Mata Atlantica programme in Brazil was set up in 1988 and receives 75% of its funding from the World Bank and 25% from the federal government. Through several meetings among the different governmental parties, the APTA network and several NGO’s involved in the execution of this programme, a general state system for environmental information was created for ecological and economic zoning, a coastal management project, and a forest monitoring system. The agroforestry systems, the management of native tree species and recovery of degraded areas using pioneer species in systems that simulate natural growth, are some good examples of improvement in the scientific and technical work performed by the Rio Doce Forestry Commission. Some indicators were defined to evaluate the effectiveness of the strategy in practice; biodiversity conservation; increase in the population of endangered species; reduction in deforestation; and increase in the numbers of visitors. Those efforts were coordinated with those of APTA as improvement of state regulations through indirect pressure; better coordination between government and business forestry sectors and state conservation programmes; research and implementation programmes for the use of appropriate seeds and agro-ecological production techniques as well as the training of the NGO’s technicians (Salles de Sa *et al.*, 1997).

According to these authors, there are several lessons learned from this experience and they mention especially the need to rely on the wholehearted support of policy- makers at the highest level and the need for the right institution to lead the strategy process; the need to bring other government sectors into the discussions; the need for a multi-disciplinary team of specialists with experience in dealing with complex process and the ability to be flexible; and

the need for strategies to be practical and viable such that the risk of error would not be allowed to prevent action.

Nigeria – Western Africa

Nigeria's strategy consists of two independently-developed initiatives - the National Conservation Strategy (NCS) and the National Environmental Action Plan (NEAP). The NCS was prepared by Nigerians and focused on the conservation of natural resources and biodiversity. It was completed in 1988 but implemented only recently. NEAP was prepared by the World Bank with Nigerian participation and its focus was the control of pollution and land degradation. It was implemented after its completion in 1990. The NCS had good local ties but was poorly funded, had poor coordination with the development planning force and virtually ignored by the NEAP. The NEAP had better international links and had been given expanded mandate by the Presidency to cover all natural resource issues. However, neither had sufficient participation of all the actors (Olojede & Saba, 1997).

Nigeria's NCS was developed after the World Conservation Strategy (WCS) was launched in 1980, to address issues of renewable resource conservation for sustainable benefits. The NCS was approved and the Natural Resources Conservation Council (NRCC) was set up to oversee its implementation. A year after the approval of NCS, the Federal Environmental Protection Agency (FEPA) requested the World Bank to define their environmental priorities and assess the kind of reform needed to redress its degradation. Instead of NEAP building on the local advantages of NRC, NEAP became associated with FEPA – for pollution control – and NCS with NRCC – for conservation of nature and natural resources. The NCS/NEAP relationship was misunderstood and confused because there were overlaps between the agencies. In 1992, the merger of NRCC with FEPA solved these overlaps and ensured coordination and integration of related activities. Olojede & Saba (1997) point out that a key advantage which NEAP had over NCS is terms of implementation was its full integration into the national plans and the annual budget provision for implementation. Another important aspect was that the government and its agencies appeared to have played a preponderant role, which could be interpreted as a reflection of the fact that the strategies evolved under military regimes only allow limited participation. The authors noted three essential lessons of the NCS/NEAP relationship, which could be summarized as: international initiatives should build on local initiatives; the contribution that international and other external agencies can make is to coordinate their assistance and ensure that it is in

conformity to the strategy in order to avoid large inappropriate loans; and a large participation and national leadership are necessary for the successful of the strategy.

Conclusion

Although the concept of preserving and optimising resources and human welfare has been more or less the norm, the Bruntland Commission's advice in 1987 of meeting "the needs of the present without compromising the ability of future generations to meet their own needs", was the first worldwide step towards recognising that humanity has the ability, in numbers and technology, to improve global systems for this generation and generations to come. The topic of sustainability distinguishes between what is currently known from what is not, and suggests that the two may be different. On one side of the on-going debate are those who are convinced the earth cannot forever support the world's demand for oil and other mineral resources. On the other side are those who are convinced that the earth with the help of market incentives, appropriate public policies, material substitution, recycling, and new technology can satisfy the world's needs indefinitely. It is impossible to know whether future trends in resource availability will either promote or frustrate the desires of people around the globe to improve their standard of living. All the proposed ideologies have been based on debatable assumptions, and in particular on assumptions about the future course of technology.

From the case studies, it is seen that sustainability cannot be developed and imposed on a community, small or large scale. Success depends on the participation and implementation by the community. From the example of Nigeria, international advice can provide assistance at crucial points, or help to move the process along, but ultimately, the community must be involved at the local level. Community members need to be the driving force for sustainable quality of life for all members, now and for future generations.

Because sustainability is a dynamic concept rather than a static state, it requires decision makers to be flexible and willing to modify their approaches according to changes in the environment, human needs and desires, or technological advances. This means that actions that contribute to sustainability today, either in perception or in reality, may be deemed detrimental tomorrow if the context changes.

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