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An Interdisciplinary Perspective**

at Afro-Euro Centre for Development Studies

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## Certificate of Authorship

This is to certify that:

**Gerhard Berchtold, Jacinta A. Opara and Shobana Nelasco**

have published the paper entitled:

### **ENVIRONMENT AND SUSTAINABLE DEVELOPMENT IN A GLOBAL AGE**

at Afro-Euro Centre for Development Studies

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## Sustainable Development – Quo Vadis ?

By Gerhard Berchtold

### Abstract – Key Words

In this paper I try to explore and provide an overview of some key concepts and policies, and a survey of literature and research findings on environment and development; in short, human society on earth increases both, the global welfare indicators and the environmental stress indicators, and the message is clear: time to act is now. **Environment as a System.** In modern reality the term “**environment**” encompasses two different features: the natural and the man-made environments and the interactions between them. We are about to become involved in trying to unravel a technological paradox: “Environmental disruption and degradation have been brought about by the modern industrial economy will be a main route to environmental quality. Two schools of thought exist in today’s discussion, those who deny any global environmental crisis, supported by followers of the technological optimists’ school (Maddox, Lomborg), stating that scientific knowledge and technology offered the greatest promise for the amelioration and cure of environmental and development problems; versus the school of deep ecology, promoting to follow the patterns of sustainability of living systems in societal and technical development (Lovelock, Martin, Capra). The most appropriate theoretical framework for ecology is the theory of living systems. The network pattern, the flow of energy, and the nutrient cycles—are essential to the new scientific conception of life. Development is to include all modern planning and project implementation to increase productivity, to modernize traditional systems, and to raise living standards. If human activity causes ecological decline, it also lowers the limits of what can realistically be aimed for through development to improve the conditions of human activity. Ecology and development are inescapably interrelated. If no new policy actions are taken, we risk irreversibly altering the environmental basis for sustained economic prosperity. Global environmental degradation is one of the most serious threats facing humankind as a result of the expansion of its activities around the globe. **Sustainable Development** known as the Brundtland Report. The new paradigm may be called an holistic world view, seeing the world as an integrated whole rather than a dissociated collection of parts. Sustainable development concepts encompass three major points of view: economic, social and environmental. Poverty eradication is a primary goal of the development community. **Actors and Areas of Action** The top 500 companies globally control about 70% of world trade, 80% of foreign investment and 30% of world GDP. **UNEP** The United Nations Environment Programme (UNEP) is the overall coordinating environmental organization of the United Nations system. Modern international environmental law dates to approximately 1972, when countries gathered for the United Nations Stockholm Conference on the Human Environment and the United Nations Environment Programme was established. Limits to Growth. Stockholm Conference led to the establishment of the United Nations Environment Programme, headquartered in Nairobi, Kenya. The Rio Conference helped establish the United Nations Commission on Sustainable Development and reaffirmed the role of the Global Environment Facility. Agenda 21 requires integrating environment and development in decision making. **European Union** - framework for European Community Environmental Policy -Treaty of the European Community. Community policy on the environment shall aim at a high level of protection taking into account the diversity of situations in the various regions of the Community. It shall be based on the precautionary principle and on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay. 6<sup>th</sup> Environmental Action Programme: A healthy environment is essential to long term prosperity and quality of life and citizens in Europe demand a high level of environmental protection. Future economic development and increasing prosperity will put pressure on the planet's capacity to sustain demands for resources or to absorb pollution. The **OECD** is a unique forum where the governments of 30 democracies work together to address the economic, social and environmental challenges of globalisation. Putting concept of sustainable development into practice is not a simple. Governments need analytical and methodological approaches to enable them to align the economic, environmental and social pillars of sustainable development in decision-making. The material basis of economies. Clean air and water are vital for human life. OECD developed Good Practices for Public Environmental Expenditure Management (PEEM) to assess the performance of institutions managing public environmental expenditure programmes. OECD has developed checklists of five major principles. One of the main conclusions from the work on PEEM in economies in transition is the need for practical management tools that managers of public expenditure programmes can use as a benchmark to improve effectiveness and efficiency. Developing appropriate environmental accounting methodologies. This holistic approach is the only practicable one for the future in light of the international standards for environmental management systems and auditing; subject to encompass both environmental reporting, environmental performance evaluation and indicators, environmentally related financial accounting and capital budgeting, elements of environmental auditing and management, life cycle analysis and issues of sustainability. Cost-benefit analysis basically compares the increases in human wellbeing (benefits) and the reductions in social welfare (costs) of a given action or policy. Concern about the social dimension of environmental policy. **Assessments and Scenarios.** Systems thinking. Life Cycle Assessment LCA requires to apply systems thinking to the interconnectedness of things. Variety of indicators relating to the social, economic and environmental dimensions of sustainable development. Cost-Benefit Analysis (CBA). Multi-Criteria Analysis (MCA) technique. Scenarios as tools for international environmental are efficient tools for synthesising and communicating complex and extensive information to decision makers and the public, can serve as useful tools in international environmental assessment for evaluating future environmental problems and assessing policies to resolve them. **Climate Change** scientific evidence on the need for urgent action has now become stronger and convincing. Future solutions - use of existing renewable energy technologies, energy efficiency, dissemination of decentralized energy technologies. Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level. Anthropogenic warming over the last three decades has likely had a discernible influence at the global scale on observed changes in many physical and biological systems. Continued GHG emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century. Adaptation to climate change is adjustment in natural or human systems in response to actual or expected climate stimuli or their effects, which moderates harm or exploits beneficial opportunities. Adaptation requires a range of inputs and actions. **Food and Energy** Consumers are key to driving sustainable production and play a central role in sustainable development. The relation between food and energy problems first became evident as a result of the oil crisis in the early 1970s. Food and energy are global problems in at least four ways. **Business and Trade** Business activities are responsible, directly or indirectly, for most human impacts on the earth's ecosystems. The lesson for business here is obvious. The present clash between business and nature, between economics and ecology, is mainly due to the fact that nature is cyclical, whereas our industrial systems are linear. To achieve such cyclical patterns, we need to fundamentally redesign our businesses and our economy. All around the world, the growth and liberalization of international trade is changing

the way we live and work. International trade constitutes a growing portion of that growing scale, making it increasingly important as a driver of environmental change. A country's well-being is not only affected by the economic impacts of trade agreements, but also by how such agreements affect the environmental and social structures. There are both threats and opportunities in this relationship for countries, the challenge, for stakeholders, is to exploit the opportunities and reduce the threats, maximize the net positive contribution that trade can make to sustainable development. The Business Charter for Sustainable Development - 16 principles, endorsed by the International Chamber of Commerce. **Health and Environmental Quality** Environmental degradation exerts significant pressure on human health. Exposure to air, water and soil pollution, to chemicals in the environment, or to noise, can cause cancer, respiratory, cardiovascular and communicable diseases, as well as poisoning and neuropsychiatric disorders. Although the direct health effects of exposure to chemicals are complex and sometimes open to debate, health problems due to harmful exposure to some chemicals are well documented. Evidence suggests that environmental problems can have a substantial impact on human health. Without sufficient efforts, the costs of healthcare from environmental pollution are likely to become greater in the years to come. **Beyond Development – Sustainable Retreat or Global Collapse** The economies of a number of very populous developing countries are growing rapidly and - barring unexpected set-backs - their GDP/capita will approach that of the developed countries. This will result in great strains on access to raw materials and energy, as well as an increase in pollution. Models explaining the rise and decline of societies, investigating the collapse of societies scientifically, employ the comparative method - necessity for both good individual studies and good comparisons, both types of studies to acquire reliable knowledge and to reach convincing conclusions: We face the risk of a global decline. The cause for hope is another consequence of the globalized modern world's interconnectedness, because we have the media and opportunity to learn from the mistakes of distant peoples and past peoples. Even if we stopped immediately all further poisoning, it would take the Earth more than a thousand years to recover from the damage we have already done, this is why it is much too late for sustainable development; what we need is a sustainable retreat. Humanity faces its greatest trial, because the Earth system is trapped in a vicious cycle of positive feedback. Humanity's grandest challenge that a vital task for the 21<sup>st</sup> century is to cope with the avalanche we have started, sixteen Mega-Problems of the 21<sup>st</sup> century. Many different factors have to be brought into play to deal with the problem. Martin: "If we understand this century and learn how to play its very complex game, our future will be magnificent. If we get it wrong we could be plunged into a new type of Dark Age."

## Introduction

"Where there are threats of serious or irreversible damages, scientific uncertainty shall not be used to postpone cost-effective measures to prevent environmental degradation."  
- Rio Declaration on Environment and Development (World Summit, 2002)

Throughout the European medieval history the prevailing dogma was Christianity as synonymous with humanity; the reality, however, was barbarism, a human slaughterhouse where the strong killed and exploited the weak. Our state of laws and society structures and welfare indicators tell us that we are living in a more humane world now, but is that true? Modern warfare in the last 100 years has killed more people than all previous wars, and the modern exposure to environmental pollution and degradation, as well as economic and social disparities is responsible for more deaths due to famine, thirst, diseases or unsafe conditions of life than all wars altogether.

The dogma of modern times is about global environment and development, rhetoric and reality embedded in the conception of sustainable development.

The well-known Tragedy of the Commons, exploited by the Economic-Man (*homo economicus*) becomes most evident with regard to environmental resources, those were for long taken to be granted free goods, as suggested even by upfront thinkers like Ludwig von Mises (1949) just sixty years ago:

"It is customary to call the end the ultimate good and the means goods. In applying this terminology economists mainly used to think as technologists and not as praxeologists. They differentiated between free goods and economic goods. They called free goods those things which, being available in superfluous abundance, do not need to be economized. Such goods are, however, not the object of any action. They are general conditions of human welfare; they are parts of the natural environment in which man lives and acts. Only the economic goods are the substratum of action. They alone are dealt with in economics." (Mises 1949)

In this paper I try to explore and provide an overview of some key concepts and policies, and a survey of literature and research findings on environment and development; in short, human society on earth increases both, the global welfare indicators and the environmental stress indicators, and the message is clear: time to act is now.

## Environment as a System

In modern reality the term "**environment**" encompasses two different features: the natural and the man-made environments and the interactions between them.

The ecological environment consists of of all environmental media (soil – including all solid raw materials, water, air), and natural ecosystems, including all forms of life (microbes, plants, insects, animals, vegetarian and carnivores) as well as the chemical, physical and biological interactions among them.

On the other hand, more than half the world's population live in cities, in urban or metropolitan areas, and no longer on the countryside. Urbans experience mainly the man-made environment, that is the social-economic and the manufactured environment we encounter today. Our environments serve the human society's infrastructure, built of bricks, stones, concrete and asphalt, buildings and facilities, machines, materials and products. People know numerous brand names, but who can differentiate more than a handful of plants growing in nature? We consider the infrastructure as being our human environment as well.

Acc. to the Open University (1999) we are about to become involved in trying to unravel a technological paradox: "Environmental disruption and degradation in a global context and on a global scale have been brought about by the modern industrial economy, but that same advancement of the industrial economy, arguably, has also been and will continue to be a main route to environmental quality."

Two schools of thought exist in today's discussion, those who deny any global environmental crisis, supported by followers of the technological optimists' school (Maddox, Lomborg), stating that scientific knowledge and technology offered the greatest promise for the amelioration and cure of environmental and development problems; versus the school of deep ecology, promoting to follow the patterns of sustainability of living systems in societal and technical development (Lovelock, Martin, Capra).

In no part of the conventional story of evolution does life create its environment. The environment is a fixture to which life adapts, or dies. (Wilding, 2000a)

Lovelock, however, is associated with *Gaia hypothesis*, that life on Earth actively keeps the surface conditions always favourable for whatever is the contemporary ensemble of organisms, and *Gaia theory*, a view of the Earth that sees it as a self-regulating system made up from the totality of organisms, the surface rocks, the ocean and the atmosphere tightly coupled as an evolving system.

A community can be thought of in terms of a system of members or agents, all with a degree of independence, but influencing each other through a rich network of connections. The system is open, that is changing over time, and dissipative. (Wilding, 2000)

The Earth's physical and biological systems (land, atmosphere and oceans) provide humans with the goods and services essential for survival and good health. Global environmental problems and the ability to meet human needs are linked through a set of physical, chemical, and biological processes. Actions taken to fulfill human needs are increasingly recognized to have local, regional and global environmental consequences. All global environmental problems are caused by the same underlying driving forces: population size, level of consumption, and choice of technologies. (Watson et.al. 1998)

According to Brian Spooner (1984) the term "ecology" was introduced by Haeckel in 1869. "His purpose was to focus attention on relationships, especially relationships with the environment, rather than on organisms and species. The coinage was taken from the Greek for household (oikos) and suggested a broader interdisciplinary perspective on phenomena in context."

Capra (1997) makes a point about the interrelations between ecology, sustainability, and community; showing that "the theory of living systems, which is now emerging at the forefront of science, offers us an appropriate theoretical framework for the understanding of the links between ecology, sustainability, and community. Systems theory is not needed for this understanding. ... The

understanding of community is extremely important today, not only for our emotional and spiritual well-being, but also for the future of our children and, in fact, for the survival of humanity. The central challenge of our time is to create and maintain sustainable communities, i.e. social, cultural, and physical environments in which we can satisfy our needs and aspirations without diminishing the chances of future generations. Since its introduction in the early 1980s, the concept of sustainability has often been distorted, co-opted, and even trivialized by being used without the ecological context that gives it its proper meaning. What is sustained in a sustainable community is not economic growth, development, market share, or competitive advantage, but the entire web of life on which our long-term survival depends. In other words, a sustainable community is designed in such a way that its ways of life, businesses, economy, physical structures, and technologies do not interfere with nature's inherent potential to sustain life. In our attempts to build and nurture sustainable communities we can learn valuable lessons from nature, because nature's ecosystems are sustainable communities of plants, animals, and microorganisms. The members of these ecological communities have coevolved over billions of years so as to maximize their sustainability. So, what we need to understand are the basic principles of organization of these sustainable ecological communities. We need to become ecologically literate. When we begin to understand the principles of ecology at a deep level, we see that they can also be understood as principles of community. Indeed, you could say that ecosystems are sustainable because they are living communities. So, community, sustainability, and ecology are inseparably connected.

The most appropriate theoretical framework for ecology is the theory of living systems. Scientists explored living systems, which means integrated wholes whose properties cannot be reduced to those of smaller parts. Although we can distinguish parts in any living system, the nature of the whole is always different from the mere sum of its parts.

Systems thinking was raised to a new level during the past twenty years ... to describe the complexity of living systems. Examples of these systems abound in nature. ... All these living systems are wholes whose specific structures arise from the interactions and interdependence of their parts. Systems theory tells us that all living systems share a set of common properties and principles of organization. This means that systems thinking can be applied to integrate academic disciplines and to discover similarities between phenomena at different levels of scale ... what we can learn and must learn is how to live sustainably. This wisdom of nature is the essence of ecoliteracy. ...

So, how do ecosystems organize themselves? ... They are all interconnected in a vast network of relationships, the web of life. Understanding ecosystems, then, leads us to understanding relationships. This is a key aspect of systems thinking. ... When you do that, you will discover certain configurations of relationships that appear again and again. This is what we call patterns. The study of relationships leads you to the study of patterns. ...

When systems thinking is applied to the study of the multiple relationships that interlink the members of the Earth Household, a few basic principles can be recognized. They may be called principles of ecology, principles of sustainability, or principles of community; or you might even call them the basic facts of life. We need a curriculum that teaches our children these fundamental facts of life —

- that an ecosystem generates no waste, one species' waste being another species' food;
- that matter cycles continually through the web of life;
- that the energy driving these ecological cycles flows from the sun;
- that diversity assures resilience;
- that life, from its beginning more than three billion years ago, did not take over the planet by combat but by cooperation, partnership, and networking. (Capra 1997)

Acc. to Capra (1997a) these three insights—the network pattern, the flow of energy, and the nutrient cycles—are essential to the new scientific conception of life.

Capra (1997b) postulates, in our attempts to build and nurture sustainable communities we can learn valuable lessons from ecosystems, which are sustainable communities of plants, animals, and microorganisms. ... There are laws of sustainability which are natural laws ... So these are some of the basic principles of ecology: interdependence, recycling, partnership, flexibility, diversity, and as a consequence of all these, sustainability. As our century comes to a close, and we go toward the beginning of a new millennium, the survival of humanity will depend on our ecological literacy, on our ability to understand these principles of ecology and live accordingly.



Being ecologically literate, or ecoliterate, means, in our view, understanding the basic principles of ecology and being able to embody them in the daily life of human communities. In particular, we believe that the principles of ecology should be the guiding principles for creating sustainable learning communities. ... Systems thinking is crucial to understand the functioning of learning communities. ... Leadership, therefore, consists to a large extent in continually facilitating the emergence of new structures and incorporating the best of them into the organization's design. This type of systemic leadership is not limited to a single individual but can be shared, and responsibility then becomes a capacity of the whole. (Capra, 1999)

A culture fostering emergence must include the freedom to make mistakes. In such a culture, experimentation is encouraged, and learning is valued as much as success. (Capra, 1997c)

## **Development**

Human action is purposeful behavior. Or we may say: Action is will put into operation and transformed into an agency, is aiming at ends and goals, is the ego's meaningful response to stimuli and to the conditions of its environment, is a person's conscious adjustment to the state of the universe that determines his life. ... Acting man is eager to substitute a more satisfactory state of affairs for a less satisfactory. ... But to make a man act, uneasiness and the image of a more satisfactory state alone are not sufficient. A third condition is required: the expectation that purposeful behavior has the power to remove or at least to alleviate the felt uneasiness. Human action is one of the agencies bringing about change. It is an element of cosmic activity and becoming. ... Man is in a position to act because he has the ability to discover causal relations which determine change and becoming in the universe. Acting requires and presupposes the category of causality. Only a man who sees the world in the light of causality is fitted to act. In this sense we may say that causality is a category of action. The category means and ends presupposes the category cause and effect. In a world without causality and regularity of phenomena there would be no field for human reasoning and human action. Such a world would be a chaos in which man would be at a loss to find any orientation and guidance. Man is not even capable of imagining the conditions of such a chaotic universe.

Where man does not see any causal relation, he cannot act. This statement is not reversible. Even when he knows the causal relation involved, man cannot act if he is not in a position to influence the cause. ...

The Ego is the unity of the acting being. ... The We is always the result of a summing up which puts together two or more Egos. ... The We cannot act otherwise than each of them acting on his own behalf. They can either all act together in accord, or one of them may act for them all. ... The road to the performance of great things must always lead through the performance of partial tasks. (Mises 1949)

Development is conceived by Spooner (1984) "generally to include all modern planning and project implementation which is designed to increase productivity, to modernize traditional systems, and to raise living standards, especially in the Third World, irrespective of the possibility of direct benefits to the investor or donor. The argument for the differentiation of three dimensions in this context should ideally be made on the basis of a careful evaluation of accumulated experience."

If human activity causes ecological decline, Spooner (1984) postulates, "it also lowers the limits of what can realistically be aimed for through development to improve the conditions of human activity. This conflict between behaviour and ambition underlies much political activity, and it is especially evident in the international arena. Ecology and development are inescapably interrelated."

The natural environment always has been exploited to fulfill human needs, but during this century the scale of our demands has grown so large that we are degrading the ecosystems upon which our health and livelihoods depend. However, socially and environmentally sustainable economic development can be realized by adopting an appropriate mix of technologies, policies, and practices that explicitly recognize the inextricable linkages among environmental systems and basic human needs. (Watson et.al. 1998)

The OECD (2008) warning is clear: "If no new policy actions are taken, within the next few decades we risk irreversibly altering the environmental basis for sustained economic prosperity. To avoid that,

urgent actions are needed to address in particular the —red light - issues of climate change, biodiversity loss, water scarcity and health impacts of pollution and hazardous chemicals.”

Yoichi Kaya (Kaya and Yokobori 1997) reflects on environment, economy, energy, and sustainable development, concluding that global environmental degradation is one of the most serious threats facing humankind as a result of the expansion of its activities around the globe. Environmental degradation cannot be singled out as an independent matter among various global issues. Also important are the interactions among economic development, stable energy supplies, and global environmental conservation.

In the last 50 years, the world has also seen enormous environmental change. Global carbon dioxide emissions have quadrupled, and the steady increase in nitrogen releases from cars and fertilizers is creating deserts of lifelessness in our oceans and lakes. One-quarter of the world’s fish stocks are depleted, and another 44 per cent are being fished at their biological limits. In 30 years, if current trends continue, two-thirds of the world will live with “water stress”— having less than 1,000 litres of water per person a year. Daily, 25,000 people die because of diseases caused by poor water management. A quarter of the world’s mammal species are at significant risk of extinction. Such environmental damage has been driven at least in part by our increasing numbers— population has increased about 2 1/2 times since 1950, to over 6 billion in 1999.

These trends are not isolated; they are fundamentally related. Much environmental damage is due to the increased scale of global economic activity. (UNEP-ETU and IISD 2000)

## **Sustainable Development**

Acc. to OECD (2006) the term “sustainable development” first appeared in the WCED’s report “Our Common Future” (also known as the Brundtland Report) in 1987. That report defined it as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. This demands a long-term perspective about the consequences of today’s activities; going beyond economic aspects to include environmental and social concerns in formulating all types of policies; also recognising that global co-operation is required to achieve sustainable economic, environmental and social conditions worldwide.

Capra (1996) postulates “the new paradigm may be called an holistic world view, seeing the world as an integrated whole rather than a dissociated collection of parts. It may also be called an ecological view, if the term ecological is used in a much broader and deeper sense than usual. Deep ecological awareness recognises the fundamental interdependence of all phenomena and the fact that, as individuals and societies, we are all embedded (and ultimately dependent on) the cyclical processes of nature.”

Addressing global environmental issues in an integrated manner, achieving a sustainable world will require improved institutional arrangements – involving governments, the private sector, nonprofit organizations, and academia – at the national, regional and global levels. (Watson et.al. 1998)

Munasinghe (OECD 2003) suggest sustainable development concepts: “While no universally acceptable practical definition of sustainable development exists, the concept has evolved to encompass three major points of view: economic, social and environmental. Each viewpoint corresponds to a domain (and a system) that has its own distinct driving forces and objectives. The economy is geared mainly towards improving human welfare, primarily through increases in the consumption of goods and services. The environmental domain focuses on protection of the integrity and resilience of ecological systems. The social domain emphasises the enrichment of human relationships, achievement of individual and group aspirations, and strengthening of values and institutions. ... Broadly speaking, sustainable development may be described as “a process for improving the range of opportunities that will enable individual human beings and communities to achieve their aspirations and full potential over a sustained period of time, while maintaining the resilience of economic, social and environmental systems” (Munasinghe 1994). In other words, sustainable development requires (i) opportunities for improving economic, social and ecological systems; and (ii) increases in adaptive capacity (Gunderson and Holling 2001). ... In summary, for both ecological and socioeconomic systems, the emphasis is on improving system health and its



dynamic ability to adapt to change across a range of spatial and temporal scales, rather than the conservation of some 'ideal' static state."

Munasinghe (OECD 2003) postulates that poverty eradication is a primary goal of the development community. An important objective of poverty alleviation is to provide poor people with enhanced physical, human and financial resources that will reduce their vulnerability. Regarding the integration of economic, social and environmental considerations, from a longer term perspective, the evolution of social, economic and ecological systems within a larger, more complex adaptive system, provides useful insights regarding the integration of the various elements of sustainable development. Two broad approaches are relevant for integrating the economic, social and environmental dimensions of sustainable development. They are distinguished by the degree to which the concepts of optimality and durability are emphasised. The degree of uncertainty involved often plays a key role in determining which approach would be preferred.

### **Actors and Areas of Action**

The reality of international environmental policy making is that, for all the political rhetoric, the large multinational companies or the transnational corporations (TNCs) play the most important roles. The top 500 companies globally control about 70% of world trade, 80% of foreign investment and 30% of world GDP. (Open University 1999)

The major actors I will briefly mention in this paper are the UNEP, the European Union and OECD, some of their actions, perspectives and publications.

### **UNEP**

The United Nations Environment Programme (UNEP) is the overall coordinating environmental organization of the United Nations system. Its mission is to provide leadership and encourage partnerships in caring for the environment by inspiring, informing and enabling nations and people to improve their quality of life without compromising that of future generations. (UNEP-ETU, IISD 2000)

Edith Brown Weiss (1992) summarizes that "international law has been based on the relationship between independent states that exercise exclusive national sovereignty over their territories. Global change is altering this vision by causing states to realize that they are locked together in sharing the use of a common global environment. While human activities have always contributed to environmental change, it is only within the last half of this century that their effects have become global and serious, and in many cases irreversible. This has led to a growing awareness that the interests of humankind must constrain the interests of individual states. Moreover, actors other than states have become essential to managing global environmental change. These developments are leading to a fundamental shift in the paradigm of international law that is evolving in the international environmental field."

Simmons (2000) summons in the early 1970's, a book, published in 30 languages with 30 million copies sold, 'The Limits to Growth' was published, a report of the Club of Rome's project on the predicament of mankind, with stunning conclusions. According to a sophisticated MIT computer model, the world would ultimately run out of many key resources. These limits would become the "ultimate" predicament to mankind.

Acc. to Edith Brown Weiss (1992) "modern international environmental law dates to approximately 1972, when countries gathered for the United Nations Stockholm Conference on the Human Environment and the United Nations Environment Programme was established. ... Ever since 1972, the scope of international agreements has expanded significantly. ... There is a growing realization in the international community that the time has come not only to monitor and research environmental risks but also to reduce them. Thus we have moved from international agreements that deal largely with research, information exchange, and monitoring to agreements that require reductions in pollutant emissions and changes in control technology. ...

And, finally, there is a moral and ethical dimension, a need to rethink humanity's global obligations, but even more: to act without rapacity, to use knowledge with wisdom, to respect interdependence, to operate without hubris and greed - these are not simply moral imperatives. They are an accurate scientific description of the means of survival. It is this compelling force of fact that may, I think, control our separatist ambitions before we overturn our planetary life."

Simmons (2000) evaluates whether The Club of Rome could have been right after all, the book's concern, however, was entirely focused on what the world might look like 100 years later. The members of the Club of Rome were a "group of 30 thoughtful, public spirited-intellec[t]s from ten different countries. The group included scientists, economists, educators, and industrialists. The group shared a common concern that mankind faced a future predicament of grave complexity, caused by a series of interrelated problems that traditional institutions and policy would not be able to cope with the issues, let alone come to grips with their full context ... postulated that if a continuation of the exponential growth of the seventies began in the world's population, its industrial output, agricultural and natural resource consumption and the pollution produced by all the above, would result in a severe constraints on all known global resources by 2050 to 2070. ... The Limits to Growth was never meant to be a doomsday book. Rather it was hoped that it would trigger a change in the flow of human trends to avoid such a doomsday."

The key message of the Limits to Growth, however, was that the issues raised had to be met by our generation. The problems were too serious and the correction time too long to pass these thorny issues onto a next generation. (Simmons 2000)

The Stockholm Conference led to the establishment of the United Nations Environment Programme, headquartered in Nairobi, Kenya. UNEP was to act as a catalyst for the environment in the United Nations system, but its means were modest compared with the dimensions of its task. Over the years, however, UNEP has launched a significant number of international agreements, and today has administrative responsibility for seven major conventions as well as many regional agreements. It has also acted as the environmental conscience of the United Nations system.

It soon became obvious that the Stockholm Conference's focus on the environment without due concern for development was not enough for the long-term advancement of the international environmental agenda. In 1985 the United Nations established the World Commission on Environment and Development, which issued its report, Our common future, in 1987. This report first articulated the concept of sustainable development systematically. This in turn became the basis for a major review of all international environmental activities in the United Nations through the United Nations Conference on Environment and Development, held in 1992 in Rio de Janeiro, Brazil. UNCED articulated an ambitious program of sustainable development, contained in the final Conference document, known as Agenda 21. The Rio Conference helped establish the United Nations Commission on Sustainable Development and reaffirmed the role of the Global Environment Facility, thus widening the organizational basis for the environment and sustainable development within the United Nations system. ... UNCED also pioneered innovative ways for the public to participate in intergovernmental processes. (UNEP-ETU and IISD 2000)

Since approximately 1980, Capra and Pauli (1995) summoned, "the concept of ecological sustainability has become one of the most important guiding principles for the global ecology movement. Introduced by Lester Brown in 1981 as the challenge to satisfy our needs without diminishing the chances of future generations, and promoted ever since in the Worldwatch Institute's annual reports, State of the World, the concept was coupled with that of development in 1987 in the UN report of the World Commission on Environment and Development (Brundtland Report). For some, the new term "sustainable development" was simply a strategy for sustaining previous patterns of development, but most people saw it as the first official attempt to integrate the desire for development with concern for the environment.

Over the following years, the idea of sustainability continued to gain wider and wider recognition, and in 1992 it was brought to the attention of millions around the world during the UN Conference on Environment and Development in Rio de Janeiro, popularly known as the "Earth Summit." The Earth Summit was a follow-up to the UN Conference on the Human Environment, held in Stockholm twenty years earlier, which had made "the environment" an issue on the international political agenda. The attendance of the Earth Summit and the parallel non-governmental events in Rio by 35,000 people,

including over a hundred heads of state, was a powerful testimony to the dramatic increase of environmental awareness during the twenty years between those two UN conferences.”

Chapter 8 of Agenda 21 requires integrating environment and development in decision making, in particular through:

- Integrating environment and development at the policy, planning and management levels;
- Providing an effective legal and regulatory framework;
- Making effective use of economic instruments and market and other incentives;
- Establishing systems for integrated environmental and economic accounting.

Chapter 23 of Agenda 21 calls for strengthening the role of major groups: Critical to the effective implementation of the objectives, policies and mechanisms agreed to by Governments in all programme areas of Agenda 21 will be the commitment and genuine involvement of all social groups. One of the fundamental prerequisites for the achievement of sustainable development is broad public participation in decision-making. Furthermore, in the more specific context of environment and development, the need for new forms of participation has emerged. This includes the need of individuals, groups and organizations to participate in environmental impact assessment procedures and to know about and participate in decisions, particularly those which potentially affect the communities in which they live and work. Individuals, groups and organizations should have access to information relevant to environment and development held by national authorities, including information on products and activities that have or are likely to have a significant impact on the environment, and information on environmental protection measures.

Chapter 29 of Agenda 21 demands strengthening the role of workers and their trade unions: The existing network of collaboration among trade unions and their extensive membership provide important channels through which the concepts and practices of sustainable development can be supported. The established principles of tripartism provide a basis for strengthened collaboration between workers and their representatives, Governments and employers in the implementation of sustainable development. The overall objective is poverty alleviation and full and sustainable employment, which contribute to safe, clean and healthy environments - the working environment, the community and the physical environment. Workers should be full participants in the implementation and evaluation of activities related to Agenda 21.

Chapter 30 of Agenda 21 highlights strengthening the role of business and industry: Business and industry, including transnational corporations, play a crucial role in the social and economic development of a country. A stable policy regime enables and encourages business and industry to operate responsibly and efficiently and to implement longer-term policies. Increasing prosperity, a major goal of the development process, is contributed primarily by the activities of business and industry. Business enterprises, large and small, formal and informal, provide major trading, employment and livelihood opportunities. Business opportunities available to women are contributing towards their professional development, strengthening their economic role and transforming social systems. Business and industry, including transnational corporations, and their representative organizations should be full participants in the implementation and evaluation of activities related to Agenda 21.

Through more efficient production processes, preventive strategies, cleaner production technologies and procedures throughout the product life cycle, hence minimizing or avoiding wastes, the policies and operations of business and industry, including transnational corporations, can play a major role in reducing impacts on resource use and the environment. Technological innovations, development, applications, transfer and the more comprehensive aspects of partnership and cooperation are to a very large extent within the province of business and industry.

Business and industry, including transnational corporations, should recognize environmental management as among the highest corporate priorities and as a key determinant to sustainable development. Some enlightened leaders of enterprises are already implementing "responsible care" and product stewardship policies and programmes, fostering openness and dialogue with employees and the public and carrying out environmental audits and assessments of compliance. These leaders in business and industry, including transnational corporations, are increasingly taking voluntary initiatives, promoting and implementing self-regulations and greater responsibilities in ensuring their activities have minimal impacts on human health and the environment. The regulatory regimes introduced in many countries and the growing consciousness of consumers and the general public and

enlightened leaders of business and industry, including transnational corporations, have all contributed to this. A positive contribution of business and industry, including transnational corporations, to sustainable development can increasingly be achieved by using economic instruments such as free market mechanisms in which the prices of goods and services should increasingly reflect the environmental costs of their input, production, use, recycling and disposal subject to country-specific conditions.

The improvement of production systems through technologies and processes that utilize resources more efficiently and at the same time produce less wastes - achieving more with less - is an important pathway towards sustainability for business and industry. Similarly, facilitating and encouraging inventiveness, competitiveness and voluntary initiatives are necessary for stimulating more varied, efficient and effective options. To address these major requirements and strengthen further the role of business and industry, including transnational corporations, the following two programmes are proposed.

## **European Union**

The framework for European Community Environmental Policy is provided in *Article 174* (ex Article 130r) of the Treaty of the European Community: Community policy on the environment shall contribute to pursuit of the following objectives: — preserving, protecting and improving the quality of the environment; — protecting human health; — prudent and rational utilisation of natural resources; — promoting measures at international level to deal with regional or worldwide environmental problems.

Community policy on the environment shall aim at a high level of protection taking into account the diversity of situations in the various regions of the Community. It shall be based on the precautionary principle and on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay.

In this context, harmonisation measures answering environmental protection requirements shall include, where appropriate, a safeguard clause allowing Member States to take provisional measures, for non-economic environmental reasons, subject to a Community inspection procedure. In preparing its policy on the environment, the Community shall take account of: — available scientific and technical data; — environmental conditions in the various regions of the Community; — the potential benefits and costs of action or lack of action; — the economic and social development of the Community as a whole and the balanced development of its regions.

The European Commission (2001) outlines the context for the new 6<sup>th</sup> Environmental Action Programme: "A healthy environment is essential to long term prosperity and quality of life and citizens in Europe demand a high level of environmental protection. Future economic development and increasing prosperity will put pressure on the planet's capacity to sustain demands for resources or to absorb pollution. At the same time, high environmental standards are an engine for innovation and business opportunities. Overall, society must work to de-couple environmental impacts and degradation from economic growth. Business must operate in a more eco-efficient way, in other words producing the same or more products with less input and less waste, and consumption patterns have to become more sustainable.

Working with the market through business and consumer interests will contribute to more sustainable production and consumption patterns. ... Business must be encouraged to innovate, for example seizing the opportunities offered by the use, development and spread of clean technologies. Individual citizens make daily decisions that directly or indirectly impact the environment. Better quality and easily accessible information on the environment and on practical matters will help shape opinions and thus decisions. Land use planning and management decisions in the Member States can have a major influence on the environment, leading to fragmentation of the countryside and pressures in urban areas and the coast."

Special attention will be paid to four priority areas for action. (Tackling climate change; Nature and Bio-diversity - protecting a unique resource; Environment and Health; Sustainable use of natural resources and management of wastes). Policy-making based on participation and sound knowledge.

The Commission proposal (European Commission 2001) explains the context for a new environmental action programme: "A clean and healthy environment is part and parcel of the prosperity and quality

of life that we desire for ourselves now and for our children in the future. People demand that the air they breathe, the water they drink and the food they eat is free of pollution and contaminants; they want to live undisturbed by noise; and they want to enjoy the beauty of the countryside, unspoilt coastlines and mountain areas. They also want a world that is not threatened by climate change.

The world's population is set to grow further. It is estimated that a person in the western world consumes up to 50 times more resources in a lifetime than the average person in a developing country. Continued economic growth in the industrialised countries coupled with population growth and the natural desire of developing countries to catch up in terms of material welfare could lead to a huge growth in demand for resources. Without better and different ways of meeting this demand, we will face unprecedented pressures and impacts on the global environment.

Protecting the environment presents us with both challenges and opportunities. It is not only that people aspire to living in a clean and healthy environment but we must also recognise that the costs and other damages caused by pollution and climate change are considerable. Protecting our environment does not have to translate into restricting growth or consumption per se. High environmental standards are also an engine for innovation - creating new markets and business opportunities. Instead, we must seek to improve the quality of economic growth and other human activities to meet our demands for goods and services and for a clean and healthy environment at the same time. We should de-couple environmental impacts and degradation from economic growth, in part, through significant improvements in ecoefficiency – using less natural resource inputs for a given level of economic output or value added. Consumption patterns need to become more sustainable. ...

Contributing to sustainable development: A prudent use of the world's natural resources and the protection of the global eco-system are a condition for sustainable development, together with economic prosperity and a balanced social development."

## **OECD**

The OECD is a unique forum where the governments of 30 democracies work together to address the economic, social and environmental challenges of globalisation. The OECD is also at the forefront of efforts to understand and to help governments respond to new developments and concerns, such as corporate governance, the information economy and the challenges of an ageing population. The Organisation provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and work to co-ordinate domestic and international policies.

The OECD member countries are: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The Commission of the European Communities takes part in the work of the OECD.

OECD Publishing disseminates widely the results of the Organisation's statistics gathering and research on economic, social and environmental issues, as well as the conventions, guidelines and standards agreed by its members.

Putting this concept of sustainable development into practice is not a simple affair postulates the OECD (2006). Governments need analytical and methodological approaches to enable them to align the economic, environmental and social pillars of sustainable development in decision-making. And there is also the challenge of forecasting the future costs and benefits of actions taken today.

All this is difficult enough, but the question of how the actions of one government or region affect their neighbours is to be addressed as well. Guidance is still lacking on how countries can develop coherent sustainable development policies which take into account their likely impact on other nations.

... Most OECD governments now have national sustainable development strategies (NSDS) in place. Countries agreed to prepare these strategies as part of Agenda 21, signed at the Rio Earth Summit in 1992. They represent the most visible manifestation of the importance of sustainable development for the policy agendas of individual OECD governments.

These strategies help countries harmonise economic, environmental and social policies and plans to increase coherency in government approaches. They enable governments to identify and remove counter-productive and duplicative schemes. Environmentally and socially responsible economic development for the benefit of future generations is more likely in countries with well-founded national sustainable development strategies.

The OECD is working with its member countries to identify good practices in national strategies regarding their content, governance, implementation and monitoring. But coherent decision-making for sustainable development is not yet a full reality. Recent assessments find that countries continue to encounter difficulties in identifying synergies and making trade-offs between the environmental, economic and social spheres. The timeframes of national strategies are often too short to take into account intergenerational and long-term considerations, which are difficult to assess in any case. And there are still numerous problems in co-coordinating the various parts of government to implement the strategies. ...

Clearly governments need ways to measure whether they are progressing towards sustainable development, and how their progress compares with that of their neighbours. We need to be able to measure the synergies and trade-offs between economic, environmental and social values. But since the concept of sustainable development includes a time element, any measure of progress towards it must also include evaluating the longer-term implications of current decisions and behaviour. And before we can measure progress, we first need to establish the current state of play as regards sustainable development.

The development of analytical frameworks and tools which could be used for sustainability assessments in a range of OECD work is a priority. Progress on defining sets of sustainable development indicators will contribute to interdisciplinary work." (OECD, 2006)

Acc. to OECD (2008c) the worldwide use of virtually every significant material has been rising over many years, causing recurrent concerns about shortages of natural resource stocks, the security of supply of energy and other materials, and the environmental effectiveness of their use. A good understanding of the material basis of the economy should therefore underpin the formulation of economic, trade, natural resource and environmental policies. The aim of Material Flow Analysis (MFA) is to contribute to that understanding.

MFA helps identify inefficient use of natural resources, energy and materials in process chains or the economy at large that would go undetected in conventional economic or environmental monitoring systems. It achieves this by using already available production, consumption and trade data in combination with environment statistics, and by improving modelling capacities.

The material basis of economies: Natural resources are fundamental for the economy and prosperity. They provide raw materials, energy, food, water and land, as well as environmental and social services.

Economic, social and environmental aspects of natural resource use: The use of materials from natural resources in human activities and the attendant production and consumption processes have many economic, social and environmental consequences that often extend beyond the borders of single countries or regions:

- ◆ From an economic perspective, the manner in which natural resources are used and managed affects (i) short-term costs and long-term economic sustainability; (ii) the supply of strategically important materials; and (iii) the productivity of economic activities and industrial sectors.

- ◆ From a social point of view, the exploitation and use of natural resources and materials affects employment, human health, and a population's recreational access to particular resources, landscapes and ecosystems. Natural resources also are a basic element of the cultural heritage of many people, notably of indigenous cultures. Furthermore, social equity considerations play a role in the way revenues and other financial flows associated with resource production and supply are managed, particularly in resource-rich countries.

- ◆ From an environmental perspective, the use of natural resources and materials needs to be considered in terms of (i) the rate of extraction and depletion of renewable and nonrenewable resource stocks; (ii) the extent of harvest and the reproductive capacity and natural productivity of renewable resources; and (iii) the associated environmental burden (e.g. pollution, waste, habitat disruption), and its effects on environmental quality (e.g. air, water, soil, biodiversity, landscape) and on related environmental services.

Managing resources well and efficiently: Making sure that natural resources and materials are managed well and used efficiently through their life cycle is key to economic growth, environmental quality and sustainable development. It helps reduce the negative environmental impacts associated with the production, consumption and end-of-life management of natural resources, a concern that has long been on the policy agenda of OECD countries. It also helps indirectly reduce demand pressures on natural resources in the context of the global economy. This is particularly important in a world where the prices of many natural resources are rising fast; and where there are often concerns

about the long-term security of supply of natural resources. Supply security is a strategic concern for governments and businesses alike; efficient management of the environmental impacts associated with using these resources will increase their long-term availability (and quality) for everyone. (OECD 2008c)

Clean air and water are vital for human life, and our societies devote large amounts of money to helping to curb pollution and preserve a healthy environment. ... So ensuring that public expenditure programmes are well-managed is an essential element of effective and efficient environmental policies. Environmental policy in OECD countries is generally guided by two key principles: that those responsible for pollution and those using natural resources should bear the full cost of their actions. As its name suggests, the Polluter-Pays-Principle (PPP), developed by the OECD in the 1970s, implies that polluters should pay to cover the full costs of any subsequent clean-up without subsidies. The User-Pays Principle states that revenue generated by users must cover all the costs related to the use of a natural resource such as water or the treatment of resultant pollution or waste.

Both the PPP and the User-Pays Principle aim at avoiding the use of public funds to deal with pollution. However, in some circumstances public spending may be necessary to limit pollution and environmental damage. The PPP specifies that public environmental expenditures may be justified if they are well-targeted (i.e. the environmental objectives to be achieved with the subsidy are clearly identified), limited in size and duration and do not introduce significant distortions to competition or trade; or when polluters cannot be identified.

Environmental public spending needs to be assessed from two angles: environmental policy and public finance. ... When choosing which environmental programmes to finance, governments should ensure that the expected social benefits from any spending programme exceed the expected social costs. (OECD 2007b)

The OECD (2007b) has developed Good Practices for Public Environmental Expenditure Management (PEEM) to assess the performance of institutions managing public environmental expenditure programmes. The OECD has studied how far the national and regional environmental funds of a number of transition economies comply with these Good Practices. The results have been used to prepare reform plans to improve the performance of the institutions involved.

The Good Practices cover three key areas: environmental effectiveness; budgetary good practice and management efficiency. Environmental effectiveness concerns the performance of public expenditure programmes as instruments of environmental policy. Budgetary good practice covers how to align the programme with the principles of sound public finance. Management efficiency considers how efficiently a financing institution uses financial and human resources.

The OECD has developed checklists of five major principles for each of these areas, plus criteria for putting them into practice. The checklists can be used to measure how far public environmental expenditure programmes comply with the Good Practices.

One of the main conclusions from the work on PEEM in economies in transition is the need for practical management tools that managers of public expenditure programmes can use as a benchmark to improve effectiveness and efficiency. (OECD 2007b)

Preserving the environment is high on the agenda for both governments and society. Governments in OECD countries are using a variety of instruments to change environmentally harmful behaviour, and taxes have proved a useful string to their bow. Using taxes to achieve an environmental objective, such as reducing emissions of a particular pollutant, is efficient from an economic point of view and offers flexibility to adapt for those affected. The environmentally related taxes raise revenues in the order of 2-2.5% of gross domestic product (GDP). The amount of revenue raised is, however, not a precise indicator of the environmental impacts of the tax and charges. Taxes and charges can trigger major behavioural changes that cut back on polluting activities, but raise small amounts of revenue because the tax-bases diminish. Indeed, many existing environmentally related taxes are contributing to environmental improvements. Tax increases are reflected in price increases, and higher prices clearly reduce demand for environmentally damaging products. (OECD 2007a)

As is stated in the UNEP/SustainAbility (1996) report initial efforts would logically first have been focused on developing appropriate environmental accounting methodologies for measuring performance and then installing full management structures and systems for auditing against these, before a company starts to report externally on their environmental performance. Unless this ideal



chronology is followed, verification and environmental benchmarking activities are next to impossible or at least very difficult. Only by implementing this entire framework will the Continuity, Comparability and Credibility of corporate environmental reporting and performance ranking be able to be substantially improved.

This holistic approach is the only practicable one for the future in light of the international standards for environmental management systems and auditing; the current initiatives to standardise environmental performance evaluation, environmental reporting and verification; as well as the rising awareness in the financial sector and subsequent need for environmental performance benchmarking tools.

The subject of environmental accounting can thus be defined broadly to encompass both environmental reporting, environmental performance evaluation and indicators, environmentally related financial accounting and capital budgeting, elements of environmental auditing and management, life cycle analysis and issues of sustainability. (OECD 2007c)

Cost-benefit analysis basically compares the increases in human wellbeing (benefits) and the reductions in social welfare (costs) of a given action or policy. So for a project or policy to qualify on cost-benefit grounds, its social benefits must exceed its social costs. Cost-benefit analysis is usually carried out for specific projects, but the scope could readily be extended to wider limits, for example, to assess policies to combat climate change.

There are different types of environmental benefits, but the overall economic value of any environmental asset is equal to its "total economic value" (TEV). This includes the "use value" and the "non-use value" of environmental assets. The use value refers to the direct benefits of actually using an environmental asset, such as water withdrawn for irrigation, harvesting of plants with medicinal value, and visits to a natural park. It also includes planned and possible future benefits of using the resource. The latter is known as the "option value". Non-use values refer to environmental assets that people will not actually use themselves at any point, but may want to preserve for others (altruism), for future generations (bequest values), or simply because they attach a value to its very existence (existence values).

When evaluating any project or policy in which an environmental asset is destroyed or depreciated, the TEV of the lost asset needs to be determined. And any positive change in the TEV of an environmental asset arising out of a project or policy would need to be counted as a benefit. (OECD 2007c)

Concern about the social dimension of environmental policy is nothing new – indeed, the importance of considering simultaneously the economic, environmental and social dimensions of sustainable development has been stressed since the concept was spelled out in the "Brundtland Report" in 1987.

There are two types of social concern related to environmental policy – those related to how environmental quality is distributed across different members of society, and those related to the distribution of the financial effects of environmental policies. (OECD 2006a)

## **Assessments and Scenarios**

Formally, a system is defined as "an assembly of components that relate to one another in an organised way and which together do something"; or "a collection of energetically and materially connected operations which perform one or more functions"; the components included in the system depend on the purpose for which the system is being modelled or studied. By surrounding the components of the system with a boundary - the system boundary - the system is clearly defined in order to ensure that problems are tackled systematically and comprehensively, however, where to draw the boundary depends on the purpose of the analysis.

Life Cycle Assessment LCA requires to apply systems thinking to the interconnectedness of things. The materials and energy utilisation system of a production plant introduces an organised way of thinking about where the input resources to manufacturing processes go and what happens to them. However, the manufacturing system with a boundary defined by the factory gate, is a subsystem of a much larger materials and energy system that LCA aims to address. (Berchtold 1995)

A wide variety of indicators relating to the social, economic and environmental dimensions of sustainable development have been discussed in the literature. In particular, we note that measuring the stocks of economic, environmental (natural), human and social capital raises various problems. Cost-Benefit Analysis (CBA) is an important tool in the economic and financial analysis of projects and for determining their viability. The basic criterion for accepting a project is that the net present value (NPV) of benefits is positive. Capturing the social dimension of sustainable development within CBA is even more problematic. The conventional CBA methodology would tend to favour the market-based economic viewpoint, although environmental and social considerations might be introduced in the form of side constraints.

Multi-Criteria Analysis (MCA) technique is particularly useful in situations where a single criterion approach like CBA falls short – especially when significant environmental and social impacts cannot be assigned monetary values. MCA is implemented usually within a hierarchical structure. The highest level represents the broad overall objectives. More explicit recognition is given to the fact that a variety of objectives and indicators may influence planning decisions. Like linking sustainable development issues with conventional decision making. The conventional decision making process in a modern economy relies on techno-engineering, financial and economic analyses of projects and policies.

A holistic environmental analysis would seek to study a physical or ecological system in its entirety. Complications arise when such natural systems cut across the structure of human society. Such work has identified basic principles that help to influence society and modify human actions, including reciprocity (or repaying favours), behaving consistently, following the lead of others, responding to those we like, obeying legitimate authorities, and valuing scarce resources [Cialdini 2001]. These insights reflect current thinking on the co-evolution of socio-economic and ecological systems. [Munasinghe (OECD 2003)]

The EEA (2001) report on scenarios as tools for international environmental assessments postulates: In our path for sustainability we need to look beyond tomorrow because to create a better future we must be able to imagine it.

Scenarios and prospective analyses are not merely attractive and intellectually challenging exercises; they are efficient tools for synthesising and communicating complex and extensive information to decision makers and the public.

Scenarios can serve as useful tools in international environmental assessment for evaluating future environmental problems and assessing policies to resolve them.

Environmental assessment is a technique providing basic information about the state of the environment for decision-making institutions, as a method deserved to keep track of society's environmental problems growing along with growth of population and economy. However, assessments deal with the current state or conditions of the environment, whereas many problems concern the future state of the environment.

Environmental studies, e.g. IPPC describes scenarios as "images of the future, or alternative futures" that are neither predictions or forecasts, but an alternative image of how the future might unfold (Nakicenovic et.al., 2000)

Thereby, they can be useful tools for assessing the future implications of current environmental problems, or the future emergence of new problems. (EEA 2001)

In most cases it was not possible to make a quantitative assessment of the environmental effectiveness of the agreements due to the lack of reliable monitoring data and consistent reporting, which prevented comparisons being made between the current situation and what would most likely have happened if no agreement had been concluded (the 'business-as-usual' situation). Some wider benefits were found, however, including environmental improvements on the situation prior to the agreement and the encouragement of environmental management in business. (EEA 1997)

## **Climate Change**

Munasinghe (OECD 2003) observes that "world decision makers are looking for new solutions to traditional development issues such as economic stagnation, persistent poverty, hunger, malnutrition, and illness, as well as newer challenges like environmental degradation and globalisation. One key approach that has received growing attention is the concept of sustainable development or 'development which lasts' (WCED 1987). Following the 1992 Earth Summit in Rio de Janeiro and the

adoption of the United Nations' Agenda 21, the goal of sustainable development has become well accepted world-wide (UN 1993).

Meanwhile, the threat of global climate change poses an unprecedented challenge to humanity. While climate change is important in the long run, it is crucial to recognise that (especially for the developing countries) there are a number of other development issues that affect human welfare more immediately – such as hunger and malnutrition, poverty, health, and pressing local environmental issues. Seen from the development viewpoint, climate change vulnerability, impacts and adaptation are the main elements of the climate change problem that resonate. Development pathways also determine emission levels, and they have implications for mitigation strategies as well.

Climate change and development interact in a circular fashion. Alternative development paths will certainly affect future climate change, and in turn, climate change will have an impact on prospects for sustainable development (for details, see IPCC, 2001). In the same context, climate change may endanger the success of some development co-operation efforts and vice versa, i.e., some development assistance efforts could (unintentionally) have repercussions for a country's emission levels or mitigation options, as well as exacerbate its vulnerability to climate change (Klein 2001)."

Teske et.al. (Greenpeace 2007) argue that the "scientific evidence on the need for urgent action on the problem of climate change has now become stronger and convincing. Future solutions would lie in the use of existing renewable energy technologies, greater efforts at energy efficiency and the dissemination of decentralized energy technologies and options. ... The good news first. Renewable energy, combined with the smart use of energy, can deliver half of the world's energy needs by 2050. ... The bad news is that time is running out. ... The world's population is expected to grow by 0.78 % over the period 2003 to 2050, rising from 6.3 to almost 8.9 billion. ... Satisfying the energy needs of a growing population in the developing regions of the world in an environmentally friendly manner is a key challenge for achieving a global sustainable energy supply. Economic growth is a key driver for energy demand ... and GDP growth is therefore a prerequisite for reducing demand in the future."

The IPCC (2007) Synthesis Report on global warming summarizes: Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level.

Observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, particularly temperature increases.

Other effects of regional climate changes on natural and human environments are emerging, although many are difficult to discern due to adaptation and non-climatic drivers.

Global GHG emissions due to human activities have grown since pre-industrial times, with an increase of 70% between 1970 and 2004.

Global atmospheric concentrations of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years.

Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations.

Anthropogenic warming over the last three decades has likely had a discernible influence at the global scale on observed changes in many physical and biological systems.

Continued GHG emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would very likely be larger than those observed during the 20th century.

Anthropogenic warming and sea level rise would continue for centuries due to the time scales associated with climate processes and feedbacks, even if GHG concentrations were to be stabilised.

Societies can respond to climate change by adapting to its impacts and by reducing GHG emissions (mitigation), thereby reducing the rate and magnitude of change.

The OECD (2007) and International Energy Agency IEA examine what "sustainable development policies and measures" (SD-PAMs) could be, and how they could be implemented and could fit into a post-2012 climate regime. The paper assumes that the option to implement SD-PAMs instead of quantified GHG emission commitments post-2012 is an option that would be likely to be only open to non-Annex I countries.

Acc. to the OECD (2005) Adaption Landscape to global warming "adaptation to climate change is defined in the Third Assessment Report of the Intergovernmental Panel on Climate Change as an

adjustment in natural or human systems in response to actual or expected climate stimuli or their effects, which moderates harm or exploits beneficial opportunities. The OECD (2007) document suggests that adaptation is much more than just about 'climate change. In the context within which most adaptation practitioners work, adaptation means increasing the resilience of communities and ecosystems against adverse climate. Adaptation requires a holistic long-term perspective that considers not only the risks, opportunities and limitations posed by current and future climate conditions, such as changes in mean climate, patterns of variability, and extremes, but also societal changes. However, adaptation does require an assessment of the patterns and trends of changing means and extremes – of climate and sea level – as they affect individual regions, countries and communities. It also means that existing institutions, such as those responsible for managing water supplies, protecting public health, responding to natural disasters, protecting coastal areas and conserving and managing forests and ecosystems should be in the forefront of designing and implementing adaptation measures. Where these institutions exist adaptation process can build on their knowledge and experience.

The OECD (2005) states that adaptation requires a range of inputs and actions, some of which are more open to external assistance than others. If it is to be effective, adaptation requires an understanding of at least the following elements:

- information and tools, e.g., in the form of data on current climate conditions, projections of climate change at the regional level, and models (at different levels) to assess the impacts of projected climate changes on key sectors such as agriculture, ecosystems, and infrastructure, technology and practices to adapt to expected changes, and a policy framework that facilitates forward planning and risk assessment/management.

## **Food and Energy**

Consumers are key to driving sustainable production and play a central role in sustainable development. Acc. to OECD (2008a) "the sustainability of consumption is considered in economic, environmental and social terms. Sustainable consumption policies increasingly take into account the social and ethical dimensions of products and how they are produced as well as their ecological impacts. Promoting sustainable consumption and production are important aspects of sustainable development, which depends on achieving long-term economic growth that is consistent with environmental and social needs. Most government policies in this area focus on stemming the environmental impacts of unsustainable industrial production practices, primarily through regulations and taxes. Promoting sustainable consumption is equally important to limit negative environmental and social externalities as well as to provide markets for sustainable products. Sustainable consumption programmes can adopt the institutional infrastructure of national sustainable development strategies (NSDS)."

The OECD (2008a) suggests that education is one of the most powerful tools for providing individuals with the appropriate skills and competencies to become sustainable consumers. Information and awareness-raising among consumers through public communications campaigns are commonly used in OECD countries to promote sustainable consumption. Subsidies and incentives are given by many OECD governments as "carrots" to encourage consumers and households to make more sustainable product and service selections. "By raising prices on less sustainable products, taxes and charges can be effective in influencing consumer behaviour towards sustainability. These tools help internalise negative externalities and let the market play the critical role of changing purchasing patterns. Taxes and charges can be more cost effective than regulations, which may require intensive monitoring efforts, in terms of enforcement and control.

Mandatory government actions to promote sustainable consumption include performance standards and mandatory labels to limit damages from products when they are consumed or used. In terms of changing consumption patterns, these tools are the most direct policy instruments for eliminating unsustainable products from the market."

For most people, Sachs and Silk (1990) argue, "the relation between food and energy problems first became evident as a result of the oil crisis in the early 1970s. While immediate attention was given by industrialized countries to ensuring adequate oil supplies to fuel their energy-intensive food systems, long-term concerns were raised about the plight of the rural and urban poor in third world countries

with the realization that the high cost of energy and fertilizers would further limit the scope of the Green Revolution.

Beyond the oil price problem loomed the second energy crisis, with even greater social and ecological consequences for more than half of the world's population. In practically all third world countries the problems of getting food to eat began to be overshadowed by the problems of acquiring the energy needed to cook it. Apart from the financial sacrifices, there was a severe strain on time budgets, notably those of women and children, who spend increasingly long hours collecting fuelwood (Cecelski 1987). These problems are exacerbated by the seasonal imbalance in biomass supply and the vicious cycle of greater quantities of dung being used as fuel rather than as fertilizer for maintaining crop production."

Food and energy are global problems in at least four ways (Sachs and Silk 1990). "First, their regular and continuing availability is a condition sine qua non of human survival, posing a formidable challenge that must be tackled simultaneously from both the supply and demand sides. Food and fuel stocks are of no help and little consolation to people who cannot afford to buy them and have no access to the resources needed to produce them.

Second, assuming optimistically that humanity will manage to solve the problems posed by its bare survival, the quality of life of millions of people will still depend to a great extent on increased supplies and better use of both food and energy; their central role in a need-oriented development strategy is only too obvious.

Third, both food and energy loom large in the North-South confrontation as potential weapons and tools of domination; hence the importance of global negotiations to modify the present gloomy picture and bring about some constructive international co-operation in both fields.

Finally, food and energy production affect and are affected by the state of the environment: energy-, land-, and water-use patterns will increasingly influence the climate and other aspects of our life-support systems. This will have far-reaching consequences for the long-term prospects of food and energy production in semi-arid areas and threatens the very existence of flood-prone coastal settlements, home to millions of people."

## **Business and Trade**

"Business activities are responsible, directly or indirectly, for most human impacts on the earth's ecosystems - and business operations today are conducted with too little thought as to their sustainability - that is, the satisfying of our own needs without diminishing the chances of future generations. The term "sustainability," which has both ecological and social components, poses business an inescapable challenge: without sustainability there will soon be no more profits. Hence, business people have a strong self-interest in minimizing the ecological damage of their operations." (Capra and Pauli, 1995)

Berchtold (1995) demonstrated proven profits from clean technologies. There are numerous examples in the literature and recommended as best available techniques (BAT) in reference documents.

The challenge is, acc. to Fritjof Capra and Gunter Pauli (1995): As the century draws to a close, environmental concerns have become of paramount importance. The survival of humanity and of the planet are at stake. Concern about the environment is no longer one of many "single issues"; it is the context of everything else - of our lives, our business, our politics. Today we are faced with a whole series of global problems which are harming the biosphere and human life in alarming ways that may soon become irreversible. The new paradigm may be called a holistic world view, seeing the world as an integrated whole rather than a dissociated collection of parts. It may also be called an ecological view, if the term "ecological" is used in a much broader and deeper sense than usual. Shallow ecology is anthropocentric. It views humans as above, or outside of nature, as the source of all value, and ascribes only instrumental, or use value to nature. Deep ecology does not separate humans from the natural environment, nor does it separate anything else from it. It does not see the world as a collection of isolated objects but rather as a network of phenomena that are fundamentally interconnected and interdependent. Deep ecology recognizes the intrinsic values of all living beings and views humans as just one particular strand in the web of life. It recognizes that we are all embedded in, and dependent upon, the cyclical processes of nature. The principle of interdependence implies a shift of perception from objects to relationships. In business this includes, among other

things, a shift from products to services. Another important principle of ecology is the cyclical nature of most ecological processes. The interactions among the members of an ecosystem involve the exchange of energy and resources in continual cycles - the water cycle, the CO<sub>2</sub> cycle and the various nutrient cycles. Communities of organisms have evolved over billions of years, continually using and recycling the same molecules of minerals, water, and air. The lesson for business here is obvious. The present clash between business and nature, between economics and ecology, is mainly due to the fact that nature is cyclical, whereas our industrial systems are linear, taking up energy and resources from the earth, transforming them into products plus waste, discarding the waste, and finally throwing away the products also after they have been used. Sustainable patterns of production and consumption need to be cyclical, imitating the processes in ecosystems. To achieve such cyclical patterns, we need to fundamentally redesign our businesses and our economy. (Capra and Pauli, 1995)

Acc. to the EEA (2006) "much environmental pollution and natural resource depletion comes from incorrect pricing of the goods and services we produce and consume. 'Market-based instruments' (MBIs) — such as taxes, charges, subsidies and tradable permits help to realise simultaneously environmental, economic and social policy objectives by taking account of the hidden costs of production and consumption to people's health and the environment, in a cost-effective way. These hidden costs include damage from air and water pollution, waste disposal, soils and species losses, climate change and the floods, heat waves and storms that it brings, and health costs. These costs are often paid by people who are not even benefiting from the use of these products, such as the next generation of children, the Arctic peoples who are on the receiving end of Europe's pollution, the poor living next to roads and factories, or pensioners without cars in big cities.

Market-based instruments can be particularly effective tools for dealing with the four major areas of action of the EU 6th environmental action programme, ... They do so by addressing the sources of environmental pollution most relevant to these areas ...

MBIs provide a stimulus to consumers and producers to change their behaviour towards more eco-efficient use of natural resources by reducing consumption per se, by stimulating technological innovation and by encouraging greater transparency on how much we pay for what. MBIs can therefore also contribute to wider sustainable development objectives in the EU and the goals of the Lisbon agenda.

Last but not least, some MBIs raise revenue that can either be earmarked as environmental expenditures, or can be used to offset taxes on labour and capital."

OECD (2001) points at the different meanings of 'competitiveness' at the national level, at the sectoral level, and for individual firms. Correcting market failures with correctly-designed environmental taxes improves the efficient use of resources and will give economies as a whole a better economic outcome.

Some WEF-2002 participants endorsed the idea of the interconnectedness of these different interest groups, and said there is a strong case to be made for linking labour and environmental issues with globalization and trade. Many agreed the global agenda is often driven by economic concerns, to the neglect of the environment, which is being depleted and degraded. They believe the environment is key to solving other problems, including labour. (WEF 2002)

UNEP's Economics and Trade Unit (ETU) is one of the units of the Division of Technology, Industry and Economics (DTIE). Its mission is to enhance capacities of countries, particularly developing countries and countries with economies in transition, to integrate environmental considerations in development planning and macroeconomic policies, including trade policies. The work program of the Unit consists of three main components: economics, trade and financial services. The trade component of the programme focuses on improving countries' understanding of the linkages between trade and environment and enhancing their capacities in developing mutually supportive trade and environment policies, and providing technical input to the trade and environment debate through a transparent and a broad-based consultative process.

All around the world, the growth and liberalization of international trade is changing the way we live and work. At \$6 trillion a year, trade flows and the rules that govern them are a massive force for economic, environmental and social change. International trade is becoming an increasingly important driver of economic development, as it has been expanding at almost twice the pace of total global economic activity for the past 15 years. A growing number of developing countries look to trade and

investment as a central part of their strategies for development, and trade considerations are increasingly important in shaping economic policy in all developed countries, too. (UNEP-ETU and IISD 2000)

Global trends: National economies are increasingly integrated in a global economic structure where all the elements needed to produce a final good or service— production of inputs, design, assembly, management, marketing, savings for investment—may be sourced from around the globe in a system held together by powerful communications and information technologies. The trend toward globalization has been driven in part by these new technologies, and in part by reduced barriers to international trade and investment flows. The result has been a steady increase in the importance of international trade in the global economy: in the last 50 years, while the global economy quintupled, world trade grew by a factor of 14.

Another important trend is increasing inequity; the benefits of growth have been unevenly spread. Although average global income now exceeds \$5,000 US per person a year, 1.3 billion people still survive on incomes of less than a dollar a day. The world's three richest people have a combined wealth greater than the GDPs of the 48 least developed countries. And the growing inequality between and within nations shows no signs of abating. (UNEP-ETU and IISD 2000)

International trade constitutes a growing portion of that growing scale, making it increasingly important as a driver of environmental change. As economic globalization proceeds and the global nature of many environmental problems becomes more evident, there is bound to be friction between the multilateral systems of law governing both.

At the most basic level, trade and the environment are related because all economic activity is based on the environment. It is the basis for all basic inputs (metals and minerals, forests and fisheries), and for the energy needed to process them. It also receives the waste products of economic activity. Trade, in turn, is affected by environmental concerns, since exporters must respond to market demands for greener goods.

At another level, environment and trade represent two distinct bodies of international law. Trade law is embodied in such structures as the World Trade Organization and regional trade agreements. Environmental law is embodied in the various multilateral environmental agreements, the regional agreements and as national and subnational regulations. It is inevitable that these two systems of law should interact. (UNEP-ETU and IISD 2000)

A country's well-being is not only affected by the economic impacts of trade agreements, but also by how such agreements affect the environmental and social structures, thus the growing interest in an assessment which considers the implications for the environment.

Environmental assessments grow out of an established legal institution in many countries, where it is required to conduct environmental reviews of certain types of projects and policies. In some countries the procedures to be followed in such reviews are spelled out in great detail. Usually, they will include extensive participation from the public as part of the process.

The challenges of conducting thorough environmental or sustainability assessments are enormous. Very few, if any, countries have adequate environmental data. And even with such data in hand, analysts then need to model how trade liberalization has impacts on the economy, and how environmental effects flow from those economic changes. If the analysis is expanded from an environmental to a sustainable development focus, we add another layer of complexity.

How do we bring in such key variables as income distribution, health, nutrition, education and urban migration? Despite the complexities, sustainability assessments will probably continue to be undertaken and refined, since a blurred vision of the future is better than none at all. (UNEP-ETU and IISD 2000)

There are both threats and opportunities in this relationship for countries, local communities and firms pursuing economic development and environmental protection.

The challenge, for all these stakeholders, is to exploit the opportunities and reduce the threats, and in so doing to maximize the net positive contribution that trade can make to sustainable development. A broader and clearer understanding of the linkages between trade, environment and development among all stakeholders is a prerequisite for seizing those opportunities and reducing those threats. (UNEP-ETU and IISD 2000)



In particular, formal assessments of the environmental impacts of trade liberalization and the trade implications of environmental policies will have to be undertaken. These assessments will have to take account of the interrelated economic and social effects of environmental and trade policies, through integrated assessment techniques. (UNEP-ETU and IISD 2000)

The Business Charter for Sustainable Development - 16 principles, endorsed by the International Chamber of Commerce: The following 16 principles make up ICC's Business Charter for Sustainable Development. They provide businesses worldwide with a basis for sound environmental management. The charter has been translated into 28 languages.

*1. Corporate priority*

*To recognize environmental management as among the highest corporate priorities and as a key determinant to sustainable development; to establish policies, programmes and practices for conducting operations in an environmentally sound manner.*

*2. Integrated management*

*To integrate these policies, programmes and practices fully into each business as an essential element of management in all its functions.*

*3. Process of improvement*

*To continue to improve corporate policies, programmes and environmental performance, taking into account technical developments, scientific understanding, consumer needs and community expectations, with legal regulations as a starting point; and to apply the same environmental criteria internationally.*

*4. Employee education*

*To educate, train and motivate employees to conduct their activities in an environmentally responsible manner.*

*5. Prior assessment*

*To assess environmental impacts before starting a new activity or project and before decommissioning a facility or leaving a site.*

*6. Products and services*

*To develop and provide products or services that have no undue environmental impact and are safe in their intended use, that are efficient in their consumption of energy and natural resources, and that can be recycled, reused, or disposed of safely.*

*7. Customer advice*

*To advise, and where relevant educate, customers, distributors and the public in the safe use, transportation, storage and disposal of products provided; and to apply similar considerations to the provision of services.*

*8. Facilities and operations*

*To develop, design and operate facilities and conduct activities taking into consideration the efficient use of energy and materials, the sustainable use of renewable resources, the minimisation of adverse environmental impact and waste generation, and the safe and responsible disposal of residual wastes.*

*9. Research*

*To conduct or support research on the environmental impacts of raw materials, products, processes, emissions and wastes associated with the enterprise and on the means of minimizing such adverse impacts.*

*10. Precautionary approach*

*To modify the manufacture, marketing or use of products or services or the conduct of activities, consistent with scientific and technical understanding, to prevent serious or irreversible environmental degradation.*

*11. Contractors and suppliers*

*To promote the adoption of these principles by contractors acting on behalf of the enterprise, encouraging and, where appropriate, requiring improvements in their practices to make them consistent with those of the enterprise; and to encourage the wider adoption of these principles by suppliers.*

*12. Emergency preparedness*

*To develop and maintain, where significant hazards exist, emergency preparedness plans in conjunction with the emergency services, relevant authorities and the local community, recognizing potential transboundary impacts.*

*13. Transfer of technology*

*To contribute to the transfer of environmentally sound technology and management methods throughout the industrial and public sectors.*

#### *14. Contributing to the common effort*

*To contribute to the development of public policy and to business, governmental and intergovernmental programmes and educational initiatives that will enhance environmental awareness and protection.*

#### *15. Openness to concerns*

*To foster openness and dialogue with employees and the public, anticipating and responding to their concerns about the potential hazards and impacts of operations, products, wastes or services, including those of transboundary or global significance.*

#### *16. Compliance and reporting*

*To measure environmental performance; to conduct regular environmental audits and assessments of compliance with company requirements, legal requirements and these principles; and periodically to provide appropriate information to the Board of Directors, shareholders, employees, the authorities and the public.*

### **Health and Environmental Quality**

Acc. to OECD (2008 b) Environmental degradation exerts significant pressure on human health. Exposure to air, water and soil pollution, to chemicals in the environment, or to noise, can cause cancer, respiratory, cardiovascular and communicable diseases, as well as poisoning and neuropsychiatric disorders.

Although the direct health effects of exposure to chemicals are complex and sometimes open to debate, health problems due to harmful exposure to some chemicals are well documented.

Evidence suggests that environmental problems can have a substantial impact on human health. Unsafe water supply, sanitation and hygiene are responsible for 3% of all deaths and 4.4% of all years of life lost (YLL) worldwide. But the poorest developing countries are the worst affected; 99% of these deaths occur in non-OECD countries and 90% of those dying are children. ... When these figures are adjusted for population size, deaths from unsafe WSH in the rest of the world are 40.5 times higher than in OECD countries, and 2.7 times higher than in the BRIICS.

At the global level, air pollution is estimated to be responsible each year for approximately 800 000 premature deaths, or 1.4% of all deaths worldwide and 6.4 million years of life lost, or 0.7% of the world total. This burden of disease is most important in developing countries, causing an estimated 39% of years of life lost in south-east Asia (e.g. China, Malaysia, Viet Nam) and 20% in other Asian countries (e.g. India, Bangladesh).

The OECD (2008b) projects an increase in premature deaths for most world regions between now and 2030. The total number of premature deaths caused by PM10 in 2030 is projected to be 3.1 million.

The OECD Environmental Outlook to 2030 also projects a sixfold increase in deaths attributable to ozone by 2030.

Examples of selected cost-benefit analyses suggest that treating environmental health issues upstream (improving the environmental conditions to prevent environment-related health problems) rather than downstream (treating the health problem) can be cost-efficient. The cost of these interventions is covered (sometimes several times over) by the health benefits they generate.

Without sufficient efforts, the costs of healthcare from environmental pollution are likely to become greater in the years to come. Appropriate environmental policies should therefore be implemented in order to address those environmental issues that cause the strongest effects on human health. OECD (2008 b)

### **Beyond Development – Sustainable Retreat or Global Collapse**

Regarding the limits to growth, José Goldemberg (Kaya and Yokobori 1997) suggests leapfrogging strategies for developing countries: "In the past it was generally accepted that economic growth, as measured by gross domestic product (GDP), was linked to the growth in consumption of raw materials and energy and in the unpleasant consequences of consumption, namely pollution.

If such linkages were to last for many decades the consequences for mankind would be disastrous. At present, only approximately a quarter of the world population (concentrated in the OECD countries) has reached a standard of living that can be considered acceptable. Of the remaining three-quarters - spread over more than 100 countries - only a small fraction has reached a reasonable standard of living; the remainder are at a level little above absolute poverty.

In the developing world (low-income economies!), GDP/capita is at least 10 times smaller than that in the OECD countries, and consumption of raw materials and energy is also at least 10 times smaller. Such disparities in income will not last forever. The economies of a number of very populous developing countries are growing rapidly and - barring unexpected set-backs - their GDP/capita will approach that of the developed countries. This will result in great strains on access to raw materials and energy, as well as an increase in pollution."

Among the various economic and social-historic models explaining the rise and decline of societies, I would like to mention the observations and conclusions of Jarred Diamond (2005), investigating the collapse of societies scientifically, suggesting to employ the comparative method to understand societal collapses to which environmental problems contribute, demonstrating that a rigorous, comprehensive, and quantitative application of this method was possible for the problem of deforestation-induced collapses. He also demands additional conclusions to be drawn from comparisons among societies, which could not have been drawn from detailed study of just a single society, suggesting that comprehension of a societal collapse requires not only accurate knowledge of its history and environment, but to place it in a broader context and gain further insights by comparing them with other societies that did or did not collapse.

Diamond has belabored the necessity for both good individual studies and good comparisons, suggesting, we need both types of studies to acquire reliable knowledge and to reach convincing conclusions. His examples include two societies, sharing the same island, but with very different cultures, such that one of those societies survived while the other was dying. Diamond also demonstrates, what a big difference one person can make, if he or she is the country's leader, making a point on people acting in full awareness of the consequences, stating that overcoming failure in anticipating or perceiving a problem is a major factor to undo group-decision-making.

Regarding the current state of globalization, Diamond sees reasons both for pessimism and for optimism about our ability to solve our current environmental problems, or, for the first time in history, we face the risk of a global decline. His remaining cause for hope is another consequence of the globalized modern world's interconnectedness, because we have the media and opportunity to learn from the mistakes of distant peoples and past peoples.

Despite overwhelming evidence of environmental deterioration, the finite availability of natural resources and fossil fuels, destruction of biodiversity and natural habitats, and overall threat of global heating, scientists, so-called "critical environmentalists" perceive - from an opportunity rather than a problem view - the glass rather half full than half empty. Björn Lomborg (2001) complains about the "constant repetition of the Litany and the often heard environmental exaggerations", suggesting that the point is to assess the state of the world through a scientific comparison with how it was before, showing us the extent of our progress. His point is that global figures summarize all the good stories as well as the ugly ones, allowing us to evaluate the seriousness of the overall situation, requiring to investigate long periods of time in order to appraise substantial developments. Lomborg suggests, without asking the essential question of "how important" we cannot prioritize and use our resources where they make the most impact.

Lomborg's message is that measuring the real state of the world, based on the most important fundamental characteristics, support his statistical conclusions that things are getting better, by challenging our usual conception of the collapse of ecosystems - a conception not keeping with reality - and postulating "mankind's lot has actually improved in terms of practically every measurable indicator". His point is, when things improve we are on the right track, and we look forward to fewer people starving in the future.

James Lovelock (2006) provides a pessimistic analysis of the state of the earth. Lovelock mentions that sustainable development, supported by the use of renewable energy, is a fashionable approach to living with the Earth and platform of green-thinking politicians, opposing this view are many still regarding global warming as a fiction and favour business as usual. Lovelock challenges science: "Science is supposed to be objective, so why has it failed to warn us sooner of these dangers?" Science is a cosy, friendly club of specialists following their numerous different stars, it tries to be

global and more than a loose collection of separated disciplines. Lovelock postulates that the few things we know about the response of the Earth to our presence is deeply disturbing: "Even if we stopped immediately all further seizing of Gaia's land and water for food and fuel production and stopped poisoning the air, it would take the Earth more than a thousand years to recover from the damage we have already done, and it may be too late even for this drastic step to save us." Lovelock, therefore, concludes: "This is why it is much too late for sustainable development; what we need is a sustainable retreat. We are so obsessed with the idea of progress and with the betterment of humanity that we regard retreat as a dirty word, something to be ashamed of."

According to Lovelock, "humanity faces its greatest trial, because the Earth system is trapped in a vicious cycle of positive feedback making global warming so serious and urgent, giving us little time left to put out the fire before it consumes the house itself. To undo the harm we have already done requires a programme whose scale dwarfs the space and military programmes in cost and size ... The time of irreversible change may be so close that it would be unwise to rely on international agreement to save civilization from the consequences of global heating ... Going further back in time, there have been hot spills similar to the one we think is now due. The most recent occurred fifty-five million years ago ... in some ways similar to our pollution of the air now and was due to the release" of a fossil carbon quantity equivalent to what we have already released by fossil fuel combustion and agriculture.

James Martin (2006) provides a vital blueprint for ensuring our future, calling it humanity's grandest challenge that a vital task for the 21<sup>st</sup> century is to cope with the avalanche we have started, and its consequences for today's young people living at a time of extraordinary opportunities and immense problems – his main theme to be taught and talked about everywhere: that the 21<sup>st</sup> century is unique in human history in that it will produce a great transition that enables humanity to survive.

Martin identifies the following sixteen Mega-Problems of the 21<sup>st</sup> century: Global Warming, Excessive Population Growth, Water Shortages, Destruction of Life in the Oceans, Mass Famine in Ill-Organized Countries, the Spread of Deserts, Pandemics, Extreme Poverty, Growth of Shantytowns, Unstoppable Global Migrations, Non-State Actors With Extreme Weapons, Violent Religious Extremism, Runaway Computer Intelligence, War that Could End Civilization, Risks to Homo Sapiens' Existence, A New Dark Age.

All of these problems are multinational. None could be solved by one country alone. Most of the problems are consequences of bad management and absence of foresight. Many different factors have to be brought into play to deal with the problem.

Simmons (2000) concludes, the "Club of Rome turned out to be right. We simply wasted 30 important years by ignoring this work."

Martin explores the trouble we are running into, indicating important solutions; he describes technologies giving us extraordinary new capabilities – which could get us into new kind of trouble – identifies the meaning of this very critical 21<sup>st</sup> century; describing a new world towards which we are heading: "If we understand this century and learn how to play its very complex game, our future will be magnificent. If we get it wrong we could be plunged into a new type of Dark Age."

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