2 The Big Picture: Comprehensive Approaches

PART ONE — INTRODUCTION

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Sustainable development has become the catchword of our decade, used and misused in many contexts. Yet it has been notoriously difficult to define the term, not to mention difficult to translate into other languages. There are dozens, if not hundreds, of definitions of sustainable development, but it has not been easy to obtain widespread agreement on a single precise wording. Two working definitions are internationally accepted. The Brundtland Commission definition, to meet the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development 1987, p. 8), is very general and only really captures the dimension of time and responsibility towards future generations. The second definition is the whole of Agenda 21, the action plan with 40 chapters negotiated and adopted at the highest level by the nations of the world at the United Nations Conference on Environment and Development in Rio de Janeiro in June 1992 (United Nations 1993). Neither of these definitions is sufficiently precise to facilitate measuring progress towards the big picture of sustainable development. At least Agenda 21 helps to map out the many aspects that need to be covered. In addition, the Rio Conference has been supplemented by other international conferences which have furthered international consensus on particular dimensions of sustainable development. These conferences include the Cairo Population Conference (1994), the Copenhagen Social Summit (1995), the Beijing Womens' Conference (1995), the Istanbul Conference on urban areas (1996), and the Rome World Food Summit (1996). In a sense, the big picture requires looking at all aspects of our present society and its development in all its multiplicity, and asking if it can last into the indefinite future.

Given the breadth of the subject, developing comprehensive approaches to measuring progress using indicators represents a considerable challenge. The many methods now being explored each reveal different and often complementary aspects of development and sustainability. This chapter will examine some of the dimensions of any comprehensive approach, and then review a variety of existing initiatives, which range from examining many separate indicators in some kind of a framework to exploring overall system properties. Some describe the major

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dimensions of sustainability that might need to be included in an overall picture. Others look at ways of communicating the idea of sustainability using indicators.

THE CONCEPT OF SUSTAINABILITY

One unifying factor in a comprehensive approach to sustainable development is the concept of sustainability itself. In a dynamic system like human society, sustainability is fundamentally a question of balance maintained over time (Dahl 1995, 1996a). Thus, it is something that cannot easily be scaled and measured, since it is a quality of motion rather than a fixed point. It may be more easily defined, in practice, as the lack of forces tending to upset an equilibrium over time. This is why most indicators are, in fact, measures of unsustainability, i.e. the amount or extent of imbalances. As with a moving pendulum or an aircraft in flight, many different forces can act simultaneously to disturb an equilibrium; if one such force is reduced or eliminated, others become predominant. Sustainability can be achieved only when all forces upsetting the balance are removed, or opposing forces are precisely balanced. A broad view must encompass all of those forces.

Because sustainability is dynamic, it includes several characteristics, such as the speed or rate of change, the size of the mass involved in the change and, thus, the inertia of the process, and the significance of the amount and rate of change relative to the initial and resulting states. For instance, in determining the sustainability of a renewable resource harvest, it would be important to know the rate of harvest and the amount harvested over a given period, relative to the total stock of the resource at the beginning and end of the period, as well as the rate of resource regeneration over the same period.

In any community or economic system, there can be many kinds or sources of unsustainability, such as the limited size of a resource, inadequate supply inputs or excessive demand for outputs, and damaging pressures (e.g. pollution, etc.). Some of these may be controllable within the system, while others are subject to outside pressures. Since most systems are complex and not well understood, cause and effect relationships are not always apparent. The challenge in developing indicators of the big picture of sustainability is to find simple ways of presenting the idea, despite the complexity and uncertainty.

VALUES AND SUSTAINABILITY

Sustainable development is inherently a value-laden concept, in that it implies responsibility for both present and future generations. It is not applied in a vacuum, but in the development activities of specific human societies and communities. Thus, it must be interpreted and given meaning in terms of the value system of a society.

Some religious or cultural groups may not see any relevance in the idea of sustainable development because they adhere to the belief that the world will soon come to an end. From this perspective, it would appear senseless to invest effort and resources in protecting the interest of future generations, and the world itself, if

the world will soon cease to exist. However, most cultures and religions have a sense of continuity with the past, solidarity with others in the present, and stewardship or trusteeship for the future. Sustainable development can give practical expression to these beliefs. Thus, there is an intimate relationship between the principles, beliefs, ethics and values underlying a society or community, and their approach to sustainable development.

The Conference on Principles of Sustainable Development Performance Measurement (Bellagio 4-8 November 1996) emphasized that any process to measure and assess sustainable development must start with, and be guided by, an articulated vision of sustainable development and clear goals that define that vision (IISD 1996; see Box 1A). A society must have some sense of where it wants to go before it can measure its success in getting there. That vision is inevitably rooted it the society's basic values. It can help to have those values and assumptions explicitly stated as a first step in designing a conceptual or organizing framework and then identifying indicators within that framework. Sustainability also requires a holistic approach, looking at the whole as well as the parts, an approach which includes issues of equity and disparity.

A comprehensive approach is, therefore, fundamental to sustainable development. Giving form to that concept, however, is more difficult, as the examples in this chapter will illustrate. Some approaches may reflect, or be conditioned by, underlying assumptions about the nature and goals of society. A materialistic perspective, for instance, will emphasize different aspects, and set different priorities, from one that puts social concerns and community relationships first, or one that gives a large place to spiritual concerns. Each of these approaches or perspectives will generate a very different vision of sustainable development. All of these must find a place in the big picture as it reaches a planetary scale.

The current concepts of indicators and indicator frameworks originate mostly within northern industrial countries and are shaped by their cultural orientation. Fortunately, other approaches and concepts are appearing more frequently. As an example, the current methods on how to evaluate environmental damage in Europe are analysed in **Box 2A.**

MULTIPLE LEVELS OF SUSTAINABILITY

The complexity of human systems, ranging from the family to global society, makes it difficult to determine the scale at which sustainability should be measured. The planetary biosphere is a closed system, apart from energy received from the sun and radiated out into space. Global sustainability involves the inflexible limits of the Earth's boundary with space. Thus, it is the ultimate test of our success or failure as a species. At the global level, it is possible to borrow from the future in time, but not from elsewhere in space. Within these global limits, many exchanges and trade-offs are possible between different components or levels of the system, and the boundaries of sustainability can become more flexible in time and space.

It is the nature of human and natural systems to form nested hierarchies of functional units and levels of organization (Dahl 1996b). The human body has cells making up tissues and organs that combine into functional systems that together make a living organism. This is, in turn, one part of various social units of organization (family, community, business or institution, religious organization, political party, nation, etc.). Issues of sustainability can, in fact, be addressed at each of these levels. Higher levels of sustainability may be impossible if the sub-units, on which they are dependent, are not themselves sustained. But sustainable components do not guarantee sustainability at higher levels of organization, since new factors may come into play at each level and in each context.

In one sense, this multiplicity of functional systems makes it easier to understand and measure sustainable development, since each distinct system is a more manageable unit. It is possible to envision the sustainability of a local community, a business enterprise, an eco-region, a nation, a regional sea, etc., while recognizing that there are interdependencies and factors that cannot be controlled within the system. However, it is also necessary to look at inter-system properties and behaviour, including those properties that are particular to the whole planetary system. There are many questions for which there are still no good answers. To what extent can sustainability be compared or combined between the levels of a system? Can it be contradictory, with parasitic or exploitative relationships between components? How do we assemble a broad picture of sustainability up through the multiple levels of organization to the planetary system itself? Here the many vertical and horizontal linkages among levels and issues are crucial. An example of a comprehensive approach to these linkages is given by Winograd in **Box 2B.**

The challenge is a contradictory one. It is necessary to simplify in order to understand, without, at the same time, losing any critical factors from our analysis. Indicators will play an important part in this process, but only once the conceptual frameworks are in place. This is why a comprehensive approach, reaching all the way to the planetary level, is essential to develop and apply the measurement of sustainability, even if the practical use of those measures is, at some subsidiary level, closer to the mechanisms for human decision-making and action.

THE DIMENSIONS OF SUSTAINABILITY

There are as many potential dimensions to sustainability as there are important dimensions of any human society. Different approaches to indicators of sustainable development have emphasized sustainability in one aspect or another. Economic indicators are the most highly developed in Western society, due to the dominance in economic thinking. Accountants think in terms of fiscal sustainability, such as in accounts where the deposits, plus interest, must balance with the withdrawals, plus charges. A financial debt is a constraint imposed in the present on our future ability to meet needs. Moreover, to the extent that the present advantage procured is insufficient to reimburse the debt, it is by definition unsustainable. Economists have a slightly broader view of economic sustainability that includes the maintenance of

assets and capital value and productivity through investments at least equal to depreciation.

The common language of economics is money. Economic indicators are aggregated by using money as a common denominator. It is only natural that money is, therefore, frequently proposed as the common measure for indicators of sustainable development. This proposal rests on the underlying assumptions that the proper monetary value can be determined for each measure. Unfortunately, economic valuation is determined by market mechanisms, and many natural and social assets and processes are not traded in the market. The use of monetary value as the common denominator for comprehensive approaches, thus faces serious methodological difficulties.

There is much concern today over the ecological sustainability of human development on this planet, with population growth and resource consumption depleting the reserves of natural resources and their renewable productive potential. At the same time, they generate quantities of waste which further damage natural systems and upset essential life support processes, such as the carbon cycle and the maintenance of stratospheric ozone. In fact, resource debts and pollution debts are accumulating and can only be eliminated through extensive future investments. Many ecological processes are so complex and so poorly understood that it is very difficult, at present, to derive indicators of ecological sustainability. At best, given present knowledge, indicators of unsustainable pressures and impacts can be used. These should be minimized in a precautionary approach to the management of such complex systems. Most environmental indicators fall into this category. Approaches to natural resources accounting in physical units also address the environmental or ecological dimension of the system. Neither one of these comes close to capturing ecological sustainability.

In this context, several attempts have been made to capture in a holistic manner, the extremely diverse nature of the human-nature interaction. Two examples are presented in this chapter: Lüdeke and Petchel-Held's concept of syndromes of global change (**Box 2C**) and Moldan's geobiosphere values, goods and services (**Box 2D**).

While there are now some indicators of human development, the issue of what might be called human sustainability (not just in the sense of population numbers or balance) has not really been addressed (see chapter 3, and specifically Boxes 3N - 3Q). People require education and training to develop their potential to become productive members of society. This is an investment like any other, and the poverty that results from the failure to make that investment and to provide people with the means of livelihood is as much a kind of debt as a financial one, representing a burden of wasted potential weighing on the future. Since the human life-span is limited, the educational investment in individuals is ultimately depreciated and lost. Sustainability in human terms thus includes those educational and cultural processes that preserve human knowledge and ensure its transmission from generation to generation. Can we indicate whether one generation knows more than a preceding one? What are the trends? Knowledge in science and technology may be increasing, but other kinds of knowledge and experience are being lost. The

whole domain of human culture and knowledge is a critical, yet undervalued and unmeasured dimension of development and thus, of sustainability. Is there some way to indicate balance here as a guide to management action?

There are also those dimensions that could be referred to as social sustainability, which may be just as crucial to what is defined as development. These have largely escaped existing systems of measurement and accountability, although the new definitions of wealth being explored by the World Bank are moving in that direction (World Bank 1995; see Boxes 2K and 3H). A developed society, for instance, is characterized by an elaborate legal system, built up over generations of legislative additions and judicial interpretations. This is also an investment in what should be considered an important part of national wealth, if only judged by its replacement value. Yet societies change, and laws are dynamic. Can we measure how well a legal system or a tax system is meeting social needs, or perhaps how cumbersome it has become, thus placing a counter-productive weight on society? Also, communities are structured into various types of institutions ranging from governmental bodies and corporations to informal associations and religious organizations. Do we have measures of the effectiveness of this social structuring, the processes of communication and decision-making that take place within them, and their evolution over time? Is social cohesion increasing or diminishing? Measures in this area might be enlightening.

One could even extend this view to what might be called moral, ethical or spiritual sustainability. An effective society depends on a shared set of values or ethical principles that define what is acceptable behaviour between individuals, and that motivate people to work together for the common interest (Dahl 1996b). Such values are the basic rules for human interaction, and thus an essential support to development. A society that is losing its moral core may appear materially successful before declining into anarchy. In theory, at least, this should also be included in a broad concept of the sustainability of human society, even if the practical problems of developing indicators in this area are daunting. An example of a very comprehensive approach that takes into account the many dimensions of sustainability is given in **Box 2E**

The crucial problem of linkages approached from different directions has been mentioned several times. In **Box 2F**, Bartelmus gives a comprehensive concept of data linkage and integration.

THE TEMPORAL DIMENSION

Any comprehensive approach to indicators for sustainable development must include both new kinds of indicators, which account for the multiple interrelated dimensions of any society that should fall within the concept of development, and new ways of accounting for sustainability over time. It is important to know not only what is put in the accounts and what indicators are used, but also how the indicators are used.

While planners and politicians tend to look only five years ahead, and see the long term as twenty years, it would seem reasonable in the broad context of global life support systems and renewable resources, to view sustainability as stretching into the indefinite future, i.e. up to half a million years, as a reasonable time span over which our actions should not be constraining future society. This will help to avoid the tendency to discount the long-term future, and will require that adequate consideration be given to fundamental and gradual processes of global balance and change.

To incorporate the sense of time, a new kind of accounting is needed, bringing in the temporal dimension, in what might perhaps be called 'chrono-economics'. Any measure of balance cannot look only at the static situation at one moment, but must look at measures integrated over time to document processes and trends. Such accounts should include past trends leading up to the present, and projections of what the future will require to achieve or maintain sustainability. Thus, present economic balance sheets for development are doubly flawed. They exclude many capital stocks and flows as externalities, and they are not adequately summed up over time, particularly with respect to the future implications of the present situation.

Nothing is permanent on this planet. Wealth is created and destroyed; energy is degraded; materials are concentrated and dispersed; useful information is increased and lost; things wear out; objects and materials have a useful life and then become waste with disposal or recycling costs; old technologies are replaced by new ones. Ageing and death are as much a part of life as reproduction and growth. Sustainability requires accounting for all of this over time. For the ultimate balance to be sustainable, the processes of maintenance, replacement and renewal must equal or exceed the processes of depreciation, degradation and loss.

We cannot automatically assume that capital replacement will take place. It requires investment, and may have preconditions that have to be taken into account. We can make some reasonable assumptions over the next 80-100 years for the needs of those people now alive, disallowing the possibility of a cataclysm. But can we be so certain about future birth rates? For instance, what if there was widespread sterilization of males by some common pollutant? Can we assume the maintenance of agricultural productivity into the future, if soils are eroding, new diseases are evolving, the genetic resource base is shrinking, and research is declining, such that the necessary investments are not being made to maintain the productive potential?

Industry may invest in a factory with a 30-year productive life, over which its depreciation is calculated and its potential profits determined. Yet if new technology makes the product obsolete in five years, 25 years of investment will be wasted and lost. The rapid growth rate of technological innovation can be counter-productive economically in terms of capital accounts integrated over time, by rendering investments obsolete prematurely.

In a stable ecosystem like a mature forest, the total productive potential is the sum of the primary productivity of all the forest plants, based on their trapping of the maximum amount of incoming sunlight. Since individual trees (and other plants) grow and die, the total productivity, at any one point in time, is the sum of

all the trees regardless of their stages of growth, from seedlings to senescent old snags. The sustainability is the replacement process by which new trees grow to fill in the canopy and replace any that are lost. A managed forest plantation may show peak productivity when all the trees are young and vigorous, but its sustainable production must be averaged over the whole planting and harvesting cycle, including the period when the trees are cut and before new seedlings are planted, when productivity drops to zero.

Any accounting system for sustainability must be able to spot failures to reinvest, as well as damage to future productive potential, and their resulting impacts on the integrated total productivity over time. This requires accounts that show all existing investments, capital stocks and productive capacity, and the actual present rate of production (which is often well below the peak capacity). They should incorporate projected depreciation, and necessary investments for maintenance, renewal or replacement, in a kind of extended life cycle accounting. The quality of the investment becomes important here, as durability is valued. It will be necessary to model technological innovation and its impact, insofar as there are rational bases for predicting this. An integrated accounting methodology should try to take into account all significant interactions, such as damage caused by one activity (e.g. pollution from industry) on another (e.g. agricultural production). It should include available human skills and knowledge, and their replacement with changing generations.

Such integrated accounting over time should help to eliminate unrealistic assumptions about the future, by incorporating the real dynamics of possible rates of change and the capacities of systems and resources, such as water resources, primary productivity, available land area, population size and density, etc. One critical factor will be the energy throughput, including both renewable and non-renewable sources. The sum of the dynamic indicators for the movements over time of all these dimensions of our total accounts will begin to define real sustainability.

It is possible that, on this new basis, some of the industrialized 'developed' countries will show frighteningly unsustainable accounts, which would demonstrate that their prosperity is based on heavy borrowing from future potential and/or on the expropriation of resources from other parts of the world, as demonstrated by the concepts of environmental footprint or of environmental space as described by Spangenberg in **Box 2G**. There may also be a tendency to rely on highly optimistic assumptions about technological replacements which will, in any case, require difficult and expensive industrial and social transitions whose future costs may be underestimated.

BEYOND SUSTAINABILITY TO SUSTAINABLE DEVELOPMENT

Any attempt to look at the whole picture of sustainable development raises fundamental questions about present systems of measurement, particularly economic measurement. It is obvious that a full accounting will require many other accounts besides economic and monetary accounts. The nature and extent of these new accounts are only now being explored, as illustrated in some of the boxes in this chapter. Much more work is needed on measurements and indicators in these new areas.

For instance, to begin to address what is fundamentally involved in sustainable development, it will be necessary to distinguish the various kinds of economic activities and the forms of wealth they create. Measures of what might be called real or 'strong' development are needed, as compared to the simple economic activity or turn-over measure of GDP. Not all forms of wealth can be substituted by another form in all circumstances, as illustrated by the expression 'you cannot eat money'. There is the inverse situation of those who may be culturally rich but who starve, not because food is unavailable, but because they cannot afford to buy it. Development is not just an increase in financial value, but a durable rise in living standards and well-being, which are factors relative to local context, culture and value systems. Sustainable development also includes concepts of equity, and thus, includes the concept of distribution of wealth, within and between generations. Wealth even changes in incremental value, with a dollar or a kilogram of rice having a different relative value to a starving Third World villager or a wealthy European. Its significance in development terms is non-linear. While they may be important to economists, transfers or redistributions from one account or place to another are not inherently part of wealth creation. They may represent equal exchanges, or increasing wealth compensated by a corresponding increase in poverty somewhere else. Real value added comes from primary productivity or from transformation or processing to add functionality, utility, durability, or other kinds of content. To determine real value, every cost and input should be accounted for, and hidden subsidies in particular should be avoided.

The maintenance of capital is also not net wealth creation or real development. It is running in order to stand still. One does not become wealthier by replacing a leaking roof, filling potholes in the street, washing the dishes, cleaning up pollution, or buying a replacement vehicle. Real development is only when new value is added by innovation or creation, the quality of life is increased, or a larger net mass of goods and services is produced and maintained, after all the costs of production and depreciation have been subtracted. This will most likely be both a much lower percentage increase, and involve different kinds of growth, than that measured today using GDP indicators.

This real or net approach to development may have important implications for national interest rates and the discounting of future value, and thus for calculations of sustainability in development. The real rate of interest on capital should probably not exceed the real rate of creative wealth generation by that capital. Most of what goes into today's interest rates and rates of return on investments are 'growth opportunities' that either compensate for inflation or represent hidden resource transfers and subsidies produced by failures in true accounting. They come, for instance, from treating natural capital resources as externalities or from exploiting the disadvantaged situations of poorer countries or social groups. They thus give a false or partial impression of what is really increasing or developing. A comprehensive view of sustainable development requires a more complete range of indicators and a more honest accounting, able to identify real wealth creation, investment and maintenance rates after deducting debt, depreciation and resource draw-down rates.

THE VARIETIES OF SUSTAINABLE DEVELOPMENT

It is also important from a comprehensive viewpoint to identify those aspects that would be inappropriate to include in a global definition of sustainable development. The diversity of world cultures and value systems provides many different perspectives, each of which may be valid in its own particular context. It would be dangerous to use indicators internationally to make value judgements about the content of development. There is great suspicion among some developing countries and non-Western cultures that environmental and sustainable development indicators will be used to force some Western set of values on them or to impose conditionality.

This problem is aggravated by the fact that, to be useful, indicators need to be evaluated relative to some target or limit. Yet setting such targets involves value judgements that are inherently culture-bound. If measures of sustainability are to be globally relevant, they must be designed so that they have sufficient flexibility to assess common themes, dimensions or trends of sustainability while remaining culturally appropriate everywhere. They should be capable of covering the full spectrum of interests from the 'super powers' to the small island developing states, from indigenous cultures to post-industrial communities, and from high-tech to no-tech situations. For environmental indicators, there may be an objective scientific basis for setting targets or limits, such as the level of pollution causing health effects, the reduction of halogenated compounds necessary to protect the ozone layer, or the amount of forest cover necessary to maintain a particular level of water flow in a catchment. Science can at least define a gradient of environmental quality along which each society can set its appropriate limit. However, on the social and economic side, limits or targets are much more value-laden and thus, indicators cannot be absolute but must be relative to each society's concepts, goals and values. They can only be decided within a country or culture, and preferably on the basis of wide consultation and participation. For this reason, the concept of international performance indicators for sustainable development is, at least at present, politically unacceptable. States do not want anyone else judging their performance or the way they define development. Moreover, they want to choose how to report their progress in international forums such as the Commission on Sustainable Development. An emphasis on the concept of sustainability, as a dynamic balance over time, measured with vector indicators related to locally set targets, may help to avoid this problem. This is described by Dahl in **Box 2H**. A need for a dynamic approach is also stressed by Hecq, who advocates the concept of elasticity in **Box 2I**.

AGGREGATION AND WEIGHTING

One challenge in building the big picture of sustainable development is how to assemble it from the many specific dimensions and interrelationships that are inevitably involved. The process of aggregation raises complex technical and methodological issues which have been referred to in the previous chapter. On what basis can many different measures or indicators be aggregated into comprehensive measures of sustainability? How can economic, social, environmental and institutional dimensions, for instance, be combined, when the units of measure, and even the conceptual approaches to evaluation, are so different? How is sustainability described when you have, for example, indicators for per capita income, the legislative basis for land use management, the level of DDT metabolites in marine mammal blubber, and the per cent of the population over 65 years old? The approaches in this chapter represent some attempts to resolve or, at least, get around this problem in a search for the larger picture.

The traditional approach of economics has been to convert all the measures into monetary values (see Boxes 2A and 2F and Chapter 3, including Boxes 3G and 3H). However, this requires that such values be set by trading in an open market, or by some surrogate measure of market worth. The problem with this approach is that many things that are easily understood to be part of, if not essential to, development are not traded in the market, and there is no rational basis for giving them monetary values. Other systems of accounting, and other units of measure, will be necessary to document sustainability in these dimensions of society, assuming that objective methods of measurement can indeed be developed.

Another factor to consider, in designing more highly aggregated indices to give an overall picture of sustainability, is the relative weight given to different component indicators. Some type of collective expert judgement has sometimes been used, or each indicator may arbitrarily be given equal weight. Weighting is particularly subject to value judgements and cultural biases that can make any approach suspect (see Box 2A).

One alternative is to let the users of the index design their own weighting. This is the approach used in the original concept of highly aggregated indices called a 'Barometer of Sustainability' proposed by Prescott-Allen (**Box 2J**). For weighting involving measures of sustainable development, the concept of sustainability as a process of balance can help to suggest a solution. Indicator values can be ranged on a non-linear scale, where more extreme problems or larger deviations from the desirable level carry more weight than small deviations. These then become unsustainability indicators, in which high values indicate a particularly damaging, unstable or undesirable situation. This weighting should be calculated according to the specific characteristics of each phenomenon, as illustrated by some examples in Figure 1. A pollution indicator might have no significance at low concentrations, might rise somewhat as moderate levels of pollution affect amenity values, and then increase sharply as the pollutant causes health impacts at high concentrations. Similarly, depleting the first five per cent of a resource may have little significance,

while depleting the last five per cent may have an enormous impact. The curve will differ depending whether the indicator is calculated for shorter or longer time intervals, such as years or decades. For some measures, there may be an optimum indicator level, such as in the availability of a micronutrient, where low levels stunt growth while excessive levels may be toxic, with deviations in either direction considered increasingly harmful.

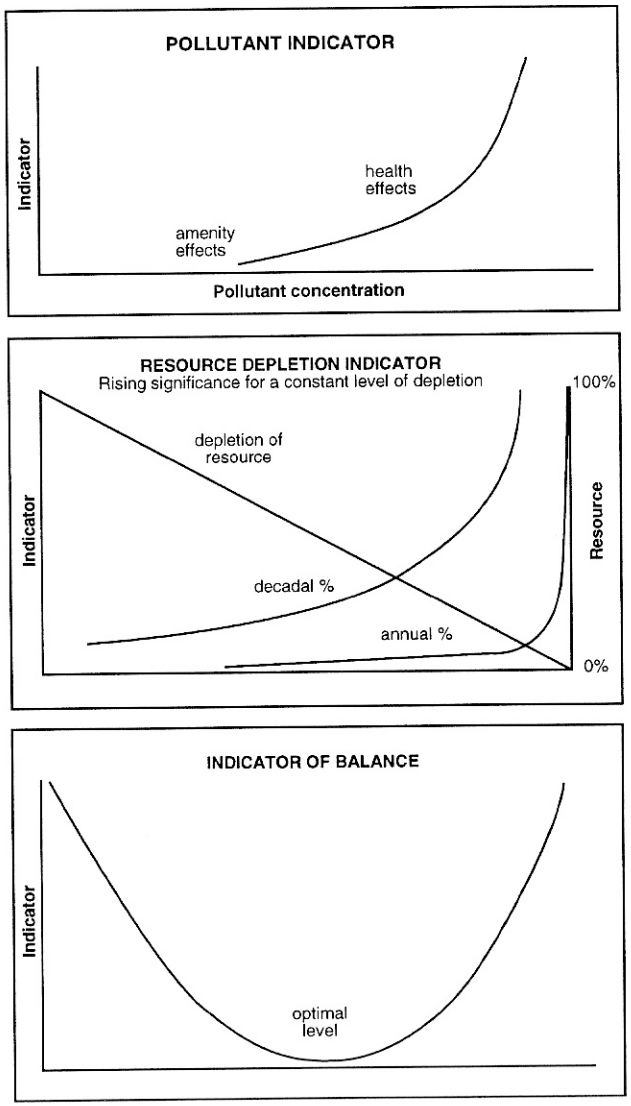

Figure 1 Unsustainability indicators (Examples of non-linear scaling)

Since one extreme problem (and thus its indicator) may in fact be much more threatening to overall sustainability than a large number of minor problems, non-linear indicators can give a more accurate measure of relative significance. The use of such non-linear scaling can facilitate the rational aggregation of indicators, since it provides a more objective criterion for relative weighting than an arbitrary combination or equal treatment. Each indicator, in effect, weighs itself in the combined aggregate according to the significance of its impact.

The difficulties involved in aggregating and weighting indicators are one reason why it is so important to have the widest possible process of consultation and participation both in the design of measures of sustainable development and in their use and interpretation. This at least can ensure that the value judgements which are made truly reflect the consensus of the society and the people most concerned, rather than being imposed by a minority or an outside group.

Several international and intergovernmental institutions regularly publish comprehensive assessments relevant to sustainable development including data and indicator sets. The United Nations Environment Programme (UNEP 1997) has started a new biennial series of reports, the *Global Environment Outlook*, that focus on the state of and trends in the planetary environment, including regional assessments of problems and priorities, and projected trends and scenarios looking twenty years or more into the future, with their policy implications. The United Nations Development Programme (UNDP) regularly includes in its *Human Development Report* an impressive set of data, indicators and indices (see Chapter 3). Similarly, the World Bank publishes an annual *World Development Report*, which has included information on the environment and sustainable development since 1992.

The World Bank is also developing a comprehensive concept called 'environmentally sustainable development'. In a recently published document *Measuring Environmental Progress: Work in Progress* (World Bank 1995), several important aspects of sustainable development are examined and appropriate indicators proposed (**Box 2K** - also see Introductory Box).

Among international non-governmental organizations, probably best known for their work on indicators are the World Resources Institute (WRI) in Washington, D.C., the International Institute for Sustainable Development in Winnipeg, Manitoba, and the Worldwatch Institute, also in Washington, D.C. WRI publishes its biennial *World Resources Report* in collaboration with UNDP, UNEP and the World Bank. The Worldwatch Institute produces an annual *State of the World* report with indicators of various trends.

As already stated, the need for indicators of sustainable development was recognized in Chapter 40 of Agenda 21. In response to this request, the UN Commission on Sustainable Development approved, at its Third Session (New York, April 1995), a work programme on indicators of sustainable development. In the framework of this work programme, several workshops and other meetings have been organized and a comprehensive document with methodologies for over 130 indicators arranged in a driving force-state-response framework was published (DPCSD 1996). These indicators are still just a list of potentially relevant measures

for assessing sustainable development at the national level. The relationships between the indicators have not been addressed, and their use to measure the broad concept of sustainability has yet to be explored. A number of countries have begun a pilot phase of testing these indicators at the national level. Feedback from this national experience, together with new methodological work in the scientific community as exemplified by this volume, will help to guide the further development of the CSD work programme. The working list of indicators is in **Box 2L**.

CLOSING REMARKS

The various comprehensive approaches summarized in this chapter demonstrate both the progress being made in trying to assess sustainable development as a whole, and the gaps and problems still remaining. The challenge for the scientific community is that highly-aggregated indices of sustainable development are being pushed by political demand, despite the hesitancy of experts and scholars to tackle questions that involve human values and political processes as much as, or more than, scientific methodologies. The above examples suggest some possible ways forward. It is particularly important that different groups of scholars and decision-makers representing a wide range of nations, cultures and value systems all explore these issues and propose approaches sensitive to their particular perspectives. It is only by comparing a variety of big pictures of sustainable development that truly comprehensive yet culturally sensitive approaches may emerge. Despite the justifiable hesitancy that many feel, we must rise to the challenge and work to develop indicators and indices that can become the driving forces towards a truly sustainable society.

NOTES

[1] The views expressed are the author's own and do not necessarily reflect those of the United Nations.

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