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TO: All Members of the World Commission on Environment
and Development.

FROM: Nitin Desai
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DATE: 20th November 1986

RE: SEVENTH MEETING OF THE COMMISSION

Commissioners will recollect that they decided at the Harare meeting to combine the first three chapters discussed there into two. Basically the material from the old Chapter 2 "Environment-Development Connection" was to be used in appropriate places in the new Chapters 1 & 2. Specific suggestions regarding this restructuring were presented at the final plenary session at Harare.

The present draft of Chapter 2 incorporates the restructuring suggested at Harare. It also incorporates a new set of introductory paragraphs and a short conclusion drafted in consultation with Commissioner Stanovnik. A new section on "Reorienting Technology and Managing Risk" has also been added as suggested at Harare. The remaining sections are essentially as discussed at Harare except for some deletions to shorten the chapter and to avoid duplication.

The present draft, which has been edited by Linda Starke, incorporates some editorial changes, new titles for the Chapter and the subsections and a tentative selection of quotations from the public hearings with an indication of roughly where they would appear in the final text.

ACTION REQUIRED: For Discussion and Approval

CHAPTER 2

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CHAPTER 2

TOWARDS SUSTAINABLE DEVELOPMENT

1. Humanity has survived and human civilizations have developed because the notion of sustainability is built into our cultures. The concept has been used in relation to land use, forestry, and fisheries for several centuries now. More recently, it has been elaborated on to formulate an ecological approach to development. Thus the World Conservation Strategy, adopted in 1980, has as its subtitle "Living Resource Conservation for Sustainable Development".^{1/}

2. The concept has many dimensions. The direct and most obvious element is the physical sustainability of development processes, which refers to the need to protect the resource base for production. These resources are more than just gifts of nature. Human ingenuity provides the technical means for using these gifts to satisfy our needs and the flexibility to modify these resources or replace them when necessary. But in a broad sense this ingenuity has to respect the integrity of natural processes. Physical sustainability in this way is closely linked to the demands generated by economic development and demographic changes. Hence the concept of sustainable development has to be extended to cover this link with economic variables as well.

3. A development path that is sustainable in a physical and economic sense could in theory be pursued even in the context of social and political rigidities. But some

considerations relating to social change must be incorporated in the objective of sustainable development for several reasons. First, even physical sustainability cannot be secured in many situations unless development programmes and policies pay specific attention to considerations like the changing access to resources and the distribution of costs and benefits. Second, economic development requires structural changes not just in the economy but also in social relations. A lack of harmony between economic and social development could lead to social tensions, which would undermine the stability essential for the pursuit of sustainable development. Finally, even the narrow notion of physical sustainability implies a concern for the social value of equity between generations, which logically should also extend to a similar concern within each generation.

4. Thus the goals of economic and social development need to be defined in terms of a broad notion of sustainability. The processes of development involve many types of participants and specific interpretations of sustainability will thus vary. But these interpretations must share certain general features. And they must flow from a consensus on the concept of sustainable development and a broad strategic framework for achieving it.

I. THE CONCEPT OF SUSTAINABLE DEVELOPMENT

5. A development path can be defined as sustainable if it meets the needs of the present without compromising the ability to do the same in the future. Several key concepts are explicit or implicit in this definition:

- * the concept of "needs", and in particular the essential needs of the world's poor, to which overriding priority should be given;

- * the idea of limitations imposed by the environment, technology, and social organization on the ability to meet needs at present and in the future; and
- * the importance of linkages between different parts of an economy and the extent to which this requires looking beyond narrow sectoral divisions.

1. Human Needs

6. The satisfaction of human needs is a major objective of development. The essential needs of vast numbers of people in developing countries - notably for food, clothing, and shelter - are not being met. A world in which poverty is endemic will always be prone to ecological as well as other crises. Sustainable development requires that the basic needs of all persons be met.

7. For most people, living standards are so low that the immediate task is to provide them with an opportunity to earn a living, enough to eat and wear, clean water to drink, a place to live, sanitary surroundings, access to education and health care, and some chance for cultural expression. Living standards that go beyond this basic minimum are sustainable provided that the existence of vast inequalities in consumption and the growing reach of modern communications does not lead to more affluent life-styles being imitated where they are not sustainable, and provided that consumption standards everywhere have regard for long-term sustainability. The massive expansion in automobile ownership and household energy use in developed countries is one example of such long-range considerations being ignored. As needs are socially and culturally determined, sustainable development requires the promotion of cultural values aimed at consumption

standards that are within the bounds of the ecological possible and that can, in principle, be aspired to by everybody.

8. The ability of societies to meet these needs is partly a question of achieving full growth potential using available technology skills, capital accumulation, effective systems of economic organization, and opportunities presented by the international economy. But this is not enough. High levels of productive activity and widespread poverty can coexist, and can endanger the environment. Hence sustainable development requires that a society's ability to meet human needs be met both by building up productive potential and by ensuring equitable opportunities for all.

9. An expansion in numbers can increase the pressure on resources and slow down the rise in living standards in areas where deprivation is widespread and concentrated in poor households. The issue is not merely one of population size but of the distribution of resources. Sustainable development can be pursued more easily if demographic developments are in harmony with the changing productive potential of the ecosystem.

10. Vast differences in income and per capita consumption still exist between and within countries. As noted in Chapter 1, these differences lead to environmental stress both because of the overuse of resources by the rich and because of short-sighted survival strategies of the poor. Where essential needs are not yet satisfied for the greater part of the population, sustainable development clearly requires economic growth. Even elsewhere it can be consistent with economic growth, provided the content of growth reflects the broad principles of sustainability and non-exploitation of others.

It has not been too difficult to push the environment lobby of the North and the development lobby of the South together. And there is now in fact a blurring of the distinction between the two, so they are coming to have a common consensus around the theme of sustainable development.

The building blocks are there. Environmental concern is common to both sides. Humanitarian concern is common to both sides. The difference lies in the methods of each and the degree to which each side tries to achieve its own economic interest through the development assistance process.

The time is right for bridging this gap for some very pragmatic political reasons. First of all, the people of the North do not want to see their taxes wasted. Secondly, they do not want to see growing poverty, and they obviously care for the environment, be it the environment of the North, where they live, or of the South. And the majority of people in the South do not want short-term overpass solutions.

In effect, there is a political community of interest, North and South, in the concept of sustainable development that you can build upon.

Richard Sandbrook
International Institute
for Environment and
Development
WCED Public Hearing
Oslo, 24-25 June 1985

11. Growth and development may meet today's needs by overexploiting resources. The direction of technological developments may solve some immediate problems but lead to even greater ones. Large sections of the population may be marginalized by ill-considered development. A society may thus compromise its future ability to meet the essential needs of its people. This need not happen. Sustainable development is a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance not merely the current but the future potential to meet human needs.

2. The Resource Base

12. As defined here, sustainable development has certain specific implications. At a minimum it must not endanger those natural systems that support the physical basis of life on Earth: the atmosphere, the hydrosphere, the geosphere, and the biomass. Settled agriculture, the diversion of watercourses, the extraction of minerals from the Earth's crust, the emission of heat and noxious gases into the atmosphere, commercial forests, and genetic manipulation are all examples of humans intervening in natural systems during the course of development. Until recently, these interventions were small in scale and limited in their impact except in some localized situations. Today's interventions are more drastic in scale and impact, and the risk to life-support systems is more evident in many areas and, in certain respects, even globally.

13. The world is still far from its limits of sustainable production. The potential is unequally distributed, however, and in many areas the limits have already been exceeded. Certain thresholds, such as the capacity of the ecosystem to absorb emissions of carbon dioxide and several radiatively active trace gases, operate at the global level. (See Chapter 1.) Moreover, the content of economic growth and development has confronted and will continue to come up against ecological limits at the regional and local level.

14. Growth has no unique limit in terms of population or resource use - with sustainability on one side and ecological disaster on the other. Different limits hold for energy use, for materials demands, for land requirements, and so on. Some of these will be approached faster than others. Many will manifest themselves in the

form of rising costs and diminishing returns rather than any sudden loss of a resource base. But ultimate limits exist, and sustainability requires that long before these are reached the world should ensure equitable access to the constrained resource and reorient technological efforts to relieve the pressure.

15. Renewable resources need not be depleted provided the rate of use is within the limits of regeneration and natural growth. Forest products and fish are typical examples. Sustainable yield is that which can be extracted and used without depleting the stock of the resource. Of course, renewable resources are generally part of a complex and interlinked ecosystem, and sustainable yield has to be defined after taking into account systemic effects. Growth and development will involve changes in the physical ecosystem. Every biome everywhere cannot be preserved intact. A forest may be depleted in one part of a watershed and extended elsewhere. This is not necessarily bad, provided systemic effects on soil erosion and water regimes have been taken into account. What is required is conservation and protection in an overall sense, and sustainability must be defined at a suitable geographical level for each type of resource.

16. Development tends to simplify ecosystems and to reduce the diversity of the natural stock of species. The genetic components of a biome are often unique, non-renewable, and non-reproducible once destroyed. Hence the loss of plant and animal species can limit greatly the options of future generations. Sustainable development requires the conservation of plant and animal species in appropriately protected areas.

17. The use of non-renewable resources by definition reduces the stock available for future generations. Yet

this does not imply that the resource should not be used at all. For if that principle were to be applied by every generation the resource would lie unused by anybody. Sustainable development requires that the depletion rate of a non-renewable resource should take into account the criticality of that resource, the availability of technologies for minimizing depletion, and the likelihood of substitute resources being available.

18. Land is a non-renewable resource, and will remain so. Hence sustainable development requires that land is not depleted through degradation. Minerals and fossil fuels, however, are different. The possibility of substitution is present; the rate of depletion and the emphasis on recycling and economy of use should be calibrated to ensure that the resource does not run out before acceptable substitutes are available. In a broad sense, sustainable development requires that the rate of depletion of non-renewable resources should foreclose as few options for future generations as possible.

19. The term resources is often unduly restricted. So-called free goods like air and water are also resources. The raw materials and energy inputs that go into the production process are converted only partly to useful products. The rest comes out as wastes that have to be absorbed. Sustainable development requires that the adverse impact of development on the quality of air, water, and other natural elements should be minimized so as to maintain the standards required to sustain the ecosystem's overall integrity.

3. Policy Linkages

20. Sustainable development cannot be achieved by dealing with the activities of one industry or sector in isolation. Sustainability could be thought of in a

A communications gap has kept environmental, population, and development assistance groups apart for too long, preventing us from being aware of our common interest and realizing our combined power. Fortunately, the gap is closing. We now know that what unites us is vastly more important than what divides us.

We recognize that poverty, environmental degradation, and population growth are inextricably related and that none of these fundamental problems can be successfully addressed in isolation. We will succeed or fail together.

Arriving at a commonly accepted definition of "sustainable development" remains a challenge for all the actors in the development process.

"Making Common Cause",
U.S.-Based Development,
Environment, Population NGOs
WCED Public Hearing
Ottawa, 26-27 May 1986

restricted manner in traditional agriculture, which was (and still is) a relatively self-contained system based largely on home-produced seeds and manures and on animate energy. Modern agriculture is very different: It uses substantial amounts of commercially produced energy and large quantities of industrial products such as fertilizers, pesticides, and agricultural machinery. At the same time, the more traditional connection - in which agriculture is a source of raw materials for industry - is being diluted by the widening use of synthetics.

21. The energy-industry connection is also changing, with a strong tendency towards a decline in the energy intensity of industrial production in developed countries due to changes in industry mix and efficiency improvements. In the Third World, however, the gradual shift of the industrial base towards the basic material-producing sectors is leading to an increase in the energy intensity of industrial production.

22. These changes in intersectoral connections create patterns of economic and ecological interdependence that are generally not reflected in the institutional arrangements for policy formulation. Energy pricing provides one example. Typically, decisions are made separately for, say, electricity, petroleum, and coal. Questions of substitutions engendered by price rises, the impact on using sectors, environmental consequences, and the implications for long-term energy policy are usually neglected.

23. The sources of environmental and ecological problems are seldom limited to one sector, as indicated in Chapter 1. The root causes of deforestation, for instance, lie in policies on energy, agriculture, industry, and trade, among others. Sectoral organizations tend to pursue sectoral objectives and treat the impact on other sectors as side-effects that they take into account only if compelled to do so. Hence the impact on forests will seldom be a major factor in the orientation of public policy or business activities in the field of energy, industrial development, crop husbandry, or foreign trade. Many of the environmental and developmental problems that confront us have their roots in this sectoral fragmentation of responsibility for a highly interrelated set of problems. Sustainable development requires that such fragmentation be overcome.

II. EQUITY AND THE COMMON INTEREST

24. Sustainable development has been described here in general, perhaps idealized, terms - without accounting for the problem of how individuals are to be persuaded, or made, to act in the common interest. This is partly a

My own personal view is that to solve this problem - for the Commission to help the African countries to see how to solve their environmental problems - they should stress a new approach to environment and development relationships. This is what will bring a solution, this is my view. It must be an approach that expresses the relationship of the African masses, the African people with not an elite group, because the environment is the business of everybody, development is the business of everybody, life and living is the business of everybody.

I think the solution will be found in encouraging mass environmental literacy so that there can be democratic and literate decisions, because if decisions are taken by a few without the incorporation of the opinion of the masses, the NGOs especially included, the likelihood is that the situations will not succeed. They will be imposed from above, the people will not respond positively to them, and the project is lost before it is launched.

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Nairobi, 23 Sept 1986

question of institutional development and law enforcement. But many problems of resource depletion and environmental stress arise from large disparities in economic and political power. An industry may get away with unacceptable levels of air and water pollution because the people who live in the most affected areas are poor and lack the means to articulate complaints. In many cases a forest is destroyed by excessive felling because the people who live there lack alternatives or because those affected by deforestation are less influential than the contractor who profits from the timber.

25. Ecological interactions do not respect the boundaries of individual property ownership and political jurisdiction, a fact recognized for centuries in many

traditional societies. Traditional systems of agriculture involved a strong dose of community control over crop rotations, timing of sowing, irrigation or harvesting, and a host of other practices. Rights to common property and traditional rights relating to water, forests, land, and air space were enforced. This enforcement of the "common interest" was not inconsistent with growth and expansion, though it may have limited the acceptance and diffusion of technical innovations. The locus for decision making shifted from the group to the individual with the upsurge of technical progress, the growing "enclosure" of common lands, the erosion of common rights in forests and other resources, and the spread of commerce and production for the market. This shift is still under way in many developing countries.

26. Physical interdependence at the local level has, if anything, increased because of the technological features of modern agriculture and manufacturing. Decisions taken by one producer or consumer affect the well-being of that person's neighbours in a direct fashion, as these examples illustrate:

- * In a watershed, the land use patterns of a farmer up the slope directly affect run-off and other conditions in farms downstream.
- * The seed varieties, irrigation practices, pesticides, and fertilizers used on one farm affect the productivity of neighbouring ones, a form of interdependence that is even more marked when holdings are small.
- * The efficiency of a boiler installed by one factory determines its rate of emission of soot and noxious chemicals and affects all who live and work around it.

- * The hot water discharged by a thermal power plant into a river or a local sea affects the catch of all who fish locally.

27. It is not that there is one set of villains and another of victims. That may be the case in some instances. But the more general situation is described by the "isolation paradox": Everyone would be better off if each person takes into account the effect of a decision on others. But each person is unwilling to assume that others will behave in this socially desirable fashion, and hence everyone continues to pursue a narrow self-interest. The authority of the community or of the government, local or national, can compensate for this isolation. Through command-and-control mechanisms, promotional programmes, taxes, and subsidies, governments can try to enforce the common interest. Legislative standards and strict liability legislation can enforce responsibility for harmful side effects. And most important, effective participation in decision-making processes by local communities can help them articulate and effectively enforce their common interest.

28. Interdependence is not, of course, simply a local phenomenon. With the growing scale and concentration of productive activity, it extends to the international plane and has both physical and economic manifestations. Increasingly there are global and regional pollution effects. More than 200 international river basins can be identified, and a large number of seas are shared. Conflicts over the use of such shared resources and transborder water pollution are common.

29. The enforcement of common interest suffers in many such cases because often a large difference exists between the span of political or administrative jurisdictions and

the area of impact. Energy policies in one jurisdiction lead to acid precipitation in another. The fishing policies of one littoral state affect the fish catch of another. No supranational authority connects this gap between area of impact and administrative jurisdiction, and the common interest can only be articulated through international cooperation.

30. In the same way, the ability of a government to control the national economy is reduced by growing international economic interactions. For example, foreign trade, particularly in primary products, shifts the locus of the environment-development connection from the national to the international level, where carrying capacity and resource scarcities should be assessed. (See Chapter 3.) In a world where economic power and the benefits of trade were more equally distributed, common interests would be generally recognized. But in reality, the gains from trade are quite unequally distributed. Moreover, trade in primary commodities affects not merely the concerned producing sector, but the entire economy and the ecology of many developing countries that depend heavily on it.

31. The articulation of the common interest would perhaps be easier if all developmental and environmental problems had solutions that would leave everyone better off. But this is seldom the case and there are winners and losers. Many problems arise from inequalities in access to resources. An unequal structure of landownership can lead to overexploitation of resources in the smallest holdings, with harmful effects both on environment and development. At the international level, monopolistic control over resources can drive those who do not share in them to excessive exploitation of marginal resources. A differential capacity to commandeer "free" goods and common property locally, nationally, and

internationally is yet another manifestation of the unequal access to resources. The asymmetry is also evident in the distribution of the health, property, and ecosystem damage costs of pollution.

32. As a system approaches ecological limits, inequalities sharpen. Thus, when a watershed deteriorates, a poor farmer suffers more by not being able to afford the same ameliorative measures as a more prosperous farmer. When urban air quality worsens, the poor, who tend to live in more vulnerable areas, suffer more health damage than the rich, who in extreme situations can protect themselves by moving. When mineral resources are depleted, late-comers to the industrialization process lose the benefits of low-cost supplies. Even at the global level, wealthier nations are better placed financially and technologically to cope with the effects of possible climatic change. Hence, the inadequacy of the mechanisms for articulating the common interest in sustainable development is inextricably linked to the relative neglect of economic and social justice within and between nations.

III. STRATEGIC IMPERATIVES

33. The immediate task before the world today is to design a strategy that will allow each nation to move from the present processes of growth and development to alternative paths with the characteristics of sustainability just described. In doing this, the critical objectives for environment and development policy are the following:

- * reviving growth;
- * changing the quality of growth;
- * meeting essential needs for food, energy, water, and sanitation;
- * ensuring a sustainable level of population;
- * dealing with an urban world;
- * conserving and enhancing the resource base;
- * reorienting technology and managing risk;
- * merging environment and economics in decision making; and
- * strengthening international cooperation.

1. Reviving Growth

34. Development that is sustainable in environmental terms cannot be pursued as long as a large number of people live in conditions of absolute poverty unable to satisfy even the most basic of their needs. As indicated in Chapter 1, poverty and deprivation intensify pressure on the environment. The greater part of this deprivation is to be found in developing countries, and in many the incidence of poverty has been aggravated by the economic stagnation of the 1980s. A necessary but not a sufficient condition for the elimination of absolute poverty is a relatively rapid rise in per capita incomes in the Third World. It is therefore essential that the stagnant or declining growth trends of this decade be reversed.

35. The growth rates that can be attained will vary greatly. To have an impact on absolute poverty, however, a certain minimum must be aimed at. Taking a hypothetical typical developing country where half the population currently lives below the poverty line, per capita national income would have to double in order to reduce this incidence of poverty to 10 per cent (see Box 2-1). If per capita income grows at 1 per cent a year, this

BOX 2-1

Growth, Redistribution, and Poverty

1. Poverty is generally defined in terms of a critical level of income below which a household cannot afford the basic necessities of life. The percentage of the population below the poverty line will depend on per capita national income and the manner in which it is distributed across different income classes. From the point of view of sustainable development, what matters is how quickly absolute poverty can be eliminated in developing countries. The answer to this question will of course vary from country to country, but much can be learned by examining a standardized and typical case.

2. Consider a case where, at present, half the population lives below the poverty line and where the distribution of household incomes is as follows: The top one-fifth of households have 50 per cent of total income, the next fifth have 20 per cent, the next fifth have 14 per cent, the next fifth have 9 per cent, and the bottom fifth have just 7 per cent. On the assumptions made here, the poverty line would be roughly 70 per cent of the average household income. This is a fair representation of the situation in most low-income developing countries.

3. In this case, if the income distribution remains unchanged, per capita national income would have to double before the poverty ratio comes down from 50 to 10 per cent. If income is redistributed in favour of the poor, this reduction can occur somewhat sooner. To get some idea of the magnitudes involved, consider two levels of redistribution. In the first, 10 per cent of the incremental income of the richest 20 per cent of the population is "taken away" and redistributed equally to the others. In the second, the proportion of income redistributed is raised from 10 to 25 per cent

4. The assumptions about redistribution reflect three judgements. First, in most situations, redistributive policies can only operate on increases in income. Second, in low-income developing countries the surplus that can be skimmed off for redistribution is available only at the top of the income distribution. Third, that redistributive policies cannot be so precisely targeted that they deliver benefits only to those who are below the poverty line, so some of the benefits will accrue to those who are just a little above it.

(Box 2-1 continued)

5. With these assumptions the number of years required to bring the poverty ratio down from 50 to 10 per cent ranges from 18 to 70 (see Box Table 2-1).

Box Table 2-1

Number of Years to Reduce Poverty Ratio
From 50 to 10 Per Cent

Redistribution Pattern	Annual Per Capita National Income Growth		
	1 Per cent	2 Per Cent	3 Per cent
	(years)		
No redistribution	70	36	24
10 per cent of top fifth's incremental income redistributed	60	31	21
25 per cent of top fifth's incremental income redistributed	51	26	18

6. The noteworthy point here is that with per capita national income growing only at 1 per cent per year, the time frame for the elimination of absolute poverty would stretch well into the next century. If, however, the aim is to ensure that the world is well on its way towards sustainable development by the beginning of the next century, it is necessary to aim at a minimum of 3 per cent per capita national income growth and to pursue vigorous redistributive policies.

situation would be reached only in the middle of the next century. One way to compress this time frame is to stress not only growth but also redistribution of incomes. Thus, in the illustrative case just given, a 3 per cent annual growth in per capita income and policy measures to shift 25 per cent of the incremental income of the richest fifth of the population could virtually eliminate poverty in two decades or so.

How can the world of nature and the community of peoples with their national economies be harmonized? Posing the question this way suggests that the two are separate. But not so. Humanity, the human species, exists and is supported within the world of nature. And I mean that not figuratively but literally.

We are deep-air animals living inside an ecological system. We draw boundaries, of course, on the ecosphere for national and regional purposes. But it is all of one piece.

When, therefore, we optimistically declare that economic development and environmental maintenance can go along hand in hand, this qualifier must immediately be added: only if the maintenance of the ecosphere is made the first priority. Economic development must be secondary, guided by strict ecological standards. These fundamental ideas are far from being universally accepted.

Stanley Rowe
Saskatchewan
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WCED Public Hearing
Ottawa, 26-27 May 1986

36. At a minimum, then, the aim should be a 3 per cent annual increase in per capita national income in each developing country. Given current growth rates of population, this would require overall national income growth of around 5 per cent a year in the developing economies of Asia, 5.5 per cent in Latin America, and 6 per cent in Africa and West Asia. How attainable are these targets?

37. In South and East Asia the record of the past quarter-century and, more particularly, of the past five years suggests that the required minimum of 5 per cent can be attained in most countries, including the two largest, India and China. In fact, per capita income growth could exceed 3 per cent on account of both higher growth rates of national income and slowing rates of population growth. In Latin America, average growth rates on the order of 5 per cent were achieved during the 1960s and 1970s but fell well below that in the first half of this

decade mainly on account of the debt crisis.^{2/} (See Chapter 3.) A revival of Latin American growth depends on the resolution of this situation.

38. In Africa, growth rates during the 1960s and 1970s were around 4-4.5 per cent, which at current rates of population growth would mean per capita income growth of only a little over 1 per cent.^{3/} However, during the 1980s the growth nearly halted and in two-thirds of the countries per capita income declined.^{4/} In fact, low-income Africa is now poorer than in 1960 and some forecasts suggest further declines over the next decade.^{5/} Population growth rates show no sign of falling; if anything, they are rising. This decline in per capita income cannot be allowed to continue. attaining a minimum level of growth in Africa requires not merely the correction of some short-term imbalance, but also measures to tackle more deep-rooted constraints on the growth process. (See Chapter 3.) The UN Programme of Action for African Economic Recovery and Development indicates an approach that could contribute to growth revival in Africa.

39. Attention has been focused here on a revival of the growth process in the developing countries because that is where the link between economic growth, the alleviation of poverty, and environmental conditions is most direct. Yet developing countries are part of an interdependent world economy, and their prospects also depend on the level and patterns of growth in developed countries. The medium-term prospects are for growth of 3-4 per cent, the minimum that international financial institutions consider necessary for developed countries to have an expansionary effect on the world economy. Growth rates of the order projected could be environmentally sustainable if recent shifts in the content of growth towards less material-and energy-intensive activities as well as improvements in the

efficiency of material and energy use are maintained.

40. This changing content of developed country growth does imply certain important changes in the pattern of growth in world trade. It suggests that raising developed country growth from its current depressed levels would not provide an adequate stimulus for those developing countries that depend mainly on primary commodity exports. Indeed, it is quite possible that fuel and mineral prices could remain weak in real terms, although the complexity of supply and demand factors precludes any confident forecast in this area.

41. The main stimulus to growth in developing countries has to come from a more rapid rise in domestic demand - including demand from other developing countries. If the focus of development is the elimination of poverty and the satisfaction of essential human needs, then substantial increases in domestic demand will arise not merely for agricultural products but also for manufactured goods and some services. Hence the very logic of sustainable development implies a considerable internal stimulus to Third World growth.

42. This does not obviate the need for a continued increase in export earnings, especially for many small states. Given the trends in world trade described earlier, the bulk of these increases must come from raising the Third World's share in the world trade in manufactures and services. Many Asian and Latin American nations are building up a substantial degree of competitive strength in this field, but this capability is quite unevenly distributed. The real task is to ensure that the smaller economies currently dependent on one or two primary products are able to diversify their domestic production structures and export capabilities. This broadening of the economic base is crucial not merely for

supporting growth in these economies, but also for sustaining the resource basis for long-term growth.

43. Apart from trade, growth in developing countries also depends on major changes in the flow of international finance. (See Chapter 3.) A recent report of the UN Committee for Development Planning has estimated that for developing countries to grow at around 5-5.5 per cent a year over the rest of the decade, the increase in official and private lending must be twice the levels expected under current conditions of capital supply.^{6/} If these additional resources are not forthcoming, the growth process is unlikely to be revived, particularly in Africa and Latin America.

2. Changing the Quality of Growth

44. Sustainable development involves more than just growth; it must embrace measures to improve the distribution of income, reduce the degree of vulnerability to economic crises, and maintain the stock of ecological capital. From the point of view of sustainability, rapid growth combined with deteriorating income distribution may well be worse than slower growth combined with a substantial redistribution in favour of the poor.

45. An example may clarify the choices involved. In many developing countries the introduction of large-scale commercial agriculture may lead to rapid production growth in the medium term but may also dispossess a large number of smallholders and greatly worsen the distribution of income. In the long run, such a path may not be sustainable because it impoverishes many people and can increase pressures on the natural resource base both from overcommercialized agriculture and from marginalized subsistence producers. An alternative path that relies

more on smallholder cultivation may be slower in the short run but more easily sustained in the long run.

46. The second element in the widening of the concept of economic development relates to vulnerability to economic crises. A bad drought may force a farmer to slaughter animals needed for sustaining production in future years. A sharp drop in prices may induce overexploitation of natural resources so as to maintain incomes. Vulnerability can, for example, be reduced by using technologies that reduce production risks, by choosing institutional options that reduce market fluctuations, and by building up reserves, notably of food and foreign exchange, for short-term difficulties. A development path that combines growth with reduced vulnerability is more sustainable than one that does not.

47. Third, economic development must be linked to the stock of capital that sustains it. For example, the income from forestry operations is conventionally measured in terms of the value of timber and other products extracted minus the costs of extraction. The costs of regenerating the forest are taken into account only to the extent they are incurred. Thus, the growth in income from forestry does not take full account of the loss of forest wealth. Similar arguments apply in other natural resource sectors; the deficiency is even greater in the case of resources that are not capitalized in enterprise or national accounts, such as the quality of air, water, or soil. The concept of economic development should therefore take full account of the improvement or deterioration in the stock of natural resources in its measure of growth.

48. Yet it is not enough to broaden the range of economic variables taken into account. Sustainability requires a wider view of the well-being of people, one

Economic indicators make no distinction between an expenditure that affects our assets and an expenditure that does not affect them. A new indicator is needed--an indicator that would make this distinction between the use of non-renewable and renewable resources. It would give us some information on whether our development is sustainable or not.

We recognize that the development of a new economic indicator is not an easy task. However, current economic indicators are not just inaccurate, they are harmful because they constantly give us the illusion of progress and an incentive towards a development that is not sustainable.

Luc Gagnon
Union Quebecoise pour la
Conservation de la Nature
WCED Public Hearing
Ottawa, 26-27 May 1986

that incorporates such non-economic variables as education and health enjoyed for their own sake, clean air and water, and the protection of natural beauty. It must also accord proper attention to the removal of disabilities from disadvantaged groups, many of whom live in ecologically vulnerable areas, sometimes because they have been pushed there by politically more dominant groups. This is the position of many tribal groups in forests, desert nomads, numerous groups in remote hill areas, and indigenous peoples of the Americas and Australasia.

49. A broader concept of development requires changes in the way development plans, projects, and policies are designed. For instance, a hydropower project should not be seen merely as a way of producing more electricity, but also as something that will affect the local environment or disturb the livelihood of a local community. Thus the abandonment of a hydro project because it will disturb a rare biome should not be considered a setback to development but a measure of progress.

50. The integration of economic and social factors in development policy need not always mean a conflict or a trade-off. In many ways, economic and social development can be mutually reinforcing. Education and health expenditures can raise the productivity of the labour force. Equally, economic development can create opportunities for accelerating social development by providing opportunities for underprivileged groups, for instance, or by spreading education more rapidly. Nevertheless, in some cases sustainability considerations will involve a rejection of activities that are economically attractive in the short run.

3. Meeting Essential Human Needs

51. The satisfaction of human needs is so obviously an objective of productive activity that it may appear to assert its central role in the concept of sustainable development. But it is certainly not. All too often poverty is such that people cannot satisfy their needs for survival and well-being even if goods and services are available. At the same time, the demands of those not in poverty may have major environmental consequences.

52. Looking ahead, it is clear that the principal challenge is to meet the needs of an expanding Third World population. The most basic of all needs is for a livelihood: that is, employment. Between 1985 and 2000 the labour force in developing countries will increase by nearly 900 million and new livelihood opportunities will have to be generated for 60 million persons every year.^{7/} The pace and pattern of economic development have to generate sustainable work opportunities on this scale and at a level of productivity that would enable poor households to meet minimum consumption standards.

In the developing world, mostly in the Third World, we realize that the main problem we have is that we do not have employment opportunities, and most of these people who are unemployed move from rural areas and they migrate into the cities and those who remain behind always indulge in processes - for example charcoal burning - and all this led to the deforestation. So maybe the environmental organizations should step in and look for ways to prevent this kind of destruction.

Kennedy Nguiro
Student, Kenya
Polytechnic
WCED Public Hearing
Nairobi, 23 Sept 1986

Yet the opportunities presented must recognize resource constraints.

53. Sufficient food is required not merely to cover the needs of more people but also to attack the backlog of undernourishment and to raise dietary standards. Dietary habits vary greatly, but if the current per capita consumption in developed countries is taken as a standard that should prevail by the year 2000, annual increases of 5.0 per cent in calories and 5.8 per cent in proteins are needed in Africa; of 3.4 and 4.0 per cent, respectively, in Latin America; and of 3.5 and 4.5 per cent in Asia.^{8/} Foodgrains and starchy roots are the primary sources of calories, while proteins are obtained primarily from products like milk, meat, fish, pulses, and oil-seeds.

54. Such increases in food requirements can be met from domestic production, from imports, or, what is particularly relevant for high-protein food items, from a reduction in exports. In most developing countries, being highly dependent on food imports greatly increases the vulnerability to international influences. Moreover, in practice, food imports (other than emergency supplies) seldom help to maintain nutrition standards of the rural

poor. And by diluting incentives, they discourage the growth of domestic food production. Hence a major challenge is to ensure that increases in food requirements are met from sustainable increases in domestic production.

55. Meeting developed country standards in the first quarter of the next century will be difficult in most (but not all) African countries, given the background of declining per capita food production and the current constraints on growth. In particular, aiming at too rapid a rate of growth may well reinforce ecologically unsound production policies and compromise the long-term prospects for food security. In Asia and Latin America, the required growth rates seem to be more readily attainable. The task here is to reconcile current levels of growth with resource conservation.

56. These projections highlight the need for a high rate of growth of protein availability. At the moment, developing countries are net exporters of protein, much of it in the form of meat and fish. Given the ecological constraints on production of these goods, it is essential that a growing portion of such production meet rising domestic demands for protein. This will require appropriate changes in production and trade policies in all countries.

57. Another essential human need is energy. This is one area where needs cannot be universally met unless energy consumption patterns are modified. The most urgent problem is the energy requirements of poor households in developing countries, who depend mainly on fuelwood. Unless countermeasures are taken, by the turn of the century, 3 billion people will suffer from a severe or absolute scarcity of fuelwood.^{9/} Alleviating this scarcity is necessary to reduce the drudgery of collecting wood from long distances as well as to preserve the

ecological base. The minimum requirements for cooking fuel in most developing countries appear to be on the order of 250 kilograms of coal equivalent per capita. This is only a fraction of the household energy consumption in developed countries, and the provision of this modest amount on a sustainable and affordable basis must be a major goal of energy policy.

58. The final cluster of basic needs that is of importance from an environmental point of view is the linked areas of housing, water supply, sanitation, and health. Deficiencies in these areas are the most visible manifestation of environmental stress. Although developed countries have, by and large, met these basic needs, the situation is far different in the Third World. Serious problems in these areas are one of the major causes of many communicable diseases, such as malaria, gastro-intestinal infestations, cholera, and typhoid. If nothing is done, the situation will worsen, particularly in urban areas, as population growth continues. Because of resource constraints a policy framework is required that relies more on supporting community initiatives and self-help efforts and on effectively using low-cost technologies.

59. Attaining minimum standards for nutrition, housing, water supply, and sanitation will go a long way towards improving the health of people in developing countries. Improvements can also be expected from the extension of primary health care facilities, the gradual control over the incidence of water-borne and vector-borne communicable diseases, the growing emphasis on maternal and child care, and other similar efforts. The goals of WHO's "Health for All" declaration are particularly important in view of the close links between environmental factors and health status and between health care and development.^{10/}

4. Ensuring a Sustainable Level of Population

60. The long-term sustainability of development is intimately linked to the dynamics of population growth. The issue, however, is not simply one of global population size. Much depends on where the growth takes place. A child born in a developed country, where levels of material and energy use are quite high, places a far greater burden on the Earth's resources than a child born in a low-income country. A similar argument applies within countries to children born in rich and poor households. Nonetheless, sustainable development can be pursued more easily the sooner population size is stabilized at a level consistent with the productive capacity of the ecosystem.

61. In developed countries, the overall rate of population growth is now under 1 per cent. Several countries have already reached or are approaching zero population growth. In many more fertility rates are below replacement levels and these, in due course, will also register zero population growth. According to 1982 UN projections, the total population of the developed world will increase from its current 1.2 billion to about 1.4 billion in the year 2025.^{11/}

62. Low levels of fertility have led some developed countries in the direction of policies oriented towards raising the birth rate because of fear that population decline will generate problems such as a shift towards older age groups and less viable small communities. But it must be noted that the 220 million who will be added to the population of developed countries over the next 40 years will, at present levels of energy and material use, add as much to global requirements as 2-2.5 billion persons in the Third World.

63. The greater part of global population increase will take place in developing countries where, according to UN projections, the 1985 population of 3.7 billion will increase to 6.8 billion by 2025.^{12/} The number of Africans is expected to nearly triple over 40 years, which implies an annual population growth rate of around 2.7 per cent. The growth expected in other developing countries is much less, particularly in China and India. However, the Third World, unlike Europe, does not have the option of migration to "new" lands, and the time available for adjustment is much less. Hence the real task now is to quicken the pace of change and, most important, to initiate the process of demographic transition in the countries where it has not begun, most notably in much of Africa.

64. Birth rates declined in developed countries largely as a consequence of economic and social development. Rising levels of income, urbanization, and the changing role of women were some of the important influences. Similar processes are now at work in developing countries. Thus it is important that this be recognized and that population policies be integrated with other economic and social development programmes, especially those relating to female education, health care, and the expansion of the livelihood base of the poor. But the pressures of time mean developing countries will also have to promote direct measures to reduce fertility. In fact, access to family planning services should itself be considered a programme of social development that allows couples, and women in particular, the right to decide family size.

65. The specific objectives that need to be pursued will vary from country to country. The momentum of population growth is such that these objectives have to be framed in

Living in Bali, Indonesia, my remarks pertain to the conditions in our island, and serve mainly to point out by way of additional illustration our common concern. The worst effect is mental or cultural pollution. I would like to especially to draw this to the attention of NGOs in Third World countries, because I understand that the Third World countries are now all being explored with a view to world tourism.

I believe that there is no choice for us but to go back to the principles demonstrated by Mahatma Gandhi in his life. This means simply going back to cleanliness, physical as well as mental, without violence.

Religion is an untapped factor. Each of us should dive deep into his or her religious tradition to find ideas that can boost our endeavour to revive our dying Earth.

Georges Bagoes Oka
Director, Bali Canti Gena
WCED Public Hearing
Jakarta, 26 March 1985

the context of the likely balance between population and productive potential many decades from now. For many countries, such projections suggest an immediate need for effective population policies.

5. Dealing with an Urban World

66. Population growth in developing countries will be quite unevenly distributed between rural and urban areas. UN projections suggest that by the first decade of the next century the absolute size of the rural population in most developing countries will start declining. Nearly 90 per cent of the increase in the Third World will take place in urban areas, the population of which is expected to rise from 1.15 billion in 1985 to 3.85 billion in 2025.^{13/} The increase is expected to be particularly marked in Africa and, to a lesser extent, in Asia.

67. Intense pressure of rapid population growth on environment will thus be felt in the cities of the developing world. The difficulty is that the pace of urbanisation is much faster than the capacity of

authorities to cope. Shortages of housing, water, sanitation, and mass transit are already widespread. A growing proportion of city-dwellers live in slums, many of them in environmentally vulnerable areas exposed to air and water pollution and to industrial hazards. A further deterioration is all the more likely given that most urban growth will probably take place in large cities. In fact, the principal gain from a slower overall rate of population growth may well be more manageable cities.

68. Urbanization is not, in itself, undesirable. In many developing countries, this process may well be essential to reduce the pressure of population growth in rural areas. The real task is to manage the process so as to avoid a severe deterioration in the quality of life. Thus the development of smaller urban centres needs to be encouraged to reduce the pressure in large cities. (See Chapter 9.)

69. The growing crisis facing cities cannot be separated from wider socio-economic and political considerations. A Third World metropolis is in fact two cities. One is the city of people who derive their income from the more formally organized part of the economic systems and who enjoy standards of housing, water supply, sanitation, space, and greenery comparable to, or even better than, a developed world city. The other is the city of those who derive their livelihood from a complex of informal economic activities, who receive little benefit from the formal structures of urban administration, and who meet their essential needs for housing, water supply, and so on mainly through self-help. It is among latter that the urban crisis is concentrated; the solutions entail the promotion of self-help housing and urban services by and for the poor, and a more positive approach to the role of an informal sector supported by sufficient funds for water supply, sanitation, and other services.

6. Conserving and Enhancing the Resource Base

70. Given the developed world's current high levels of consumption, the increases in consumption needed to meet minimum standards in developing countries, and the expected growth in population, the Earth's natural resource base must be conserved and even enhanced if needs are to be met on a sustainable basis. However, the case for the conservation of nature in the broadest sense should not rest only on the instrumental grounds that it will help promote long-term development. It must rest on a moral obligation to other living beings as well as an obligation to foreclose as few options as possible for future generations.

71. The adequacy of land resources in relation to population is a matter for particular concern. There is some margin of unused arable land in some developed countries, but it is of limited relevance since these countries will by and large not experience any pressure on land from rising food requirements.

72. In Africa, a substantial area of potentially arable land is as yet uncultivated, but with rising population this situation will change rapidly. Certain inherent limitations of soil quality, water availability, and climatic variability also limit the productive potential of the continent. The developing countries of Asia in contrast, have little unused arable land. With rising population and the growing requirements of living space, the existing ratio of land to people, already the lowest in the world, will decline further. Unlike Africa, however, the limitations on fertility are less acute. Only Latin America has scope for large-scale expansion. But a substantial part of the unused arable land is in the lightly populated Amazon Basin, where little is known as

yet about selecting land for settlement and cultivation on an ecologically sustainable basis.

73. The pressures on land for agriculture in developing countries, especially in Asia and Africa, can best be relieved and hence the resource base conserved - by increasing productivity. Per hectare yields in most of the Third World are well below their potential and can be raised substantially, as is already occurring in Asia. But improvements in land productivity will create different forms of ecological stress. The standard technology relies heavily on the use of a limited number of high-yielding seed varieties, the extensive use of irrigation (in some areas), and the application of large doses of chemical fertilisers and pesticides. Experience with high-productivity technology shows that the risks include the loss of genetic diversity in standing crops, salinization and alkalization of irrigated lands, nitrate pollution of ground-water, and pesticide residues in food. (See Chapters 1 and 5.)

74. Ecologically more benign alternatives are available, and future productivity growth should be based on more controlled application of water and agrochemicals, as well as more extensive use of organic manures and non-chemical means of pest control. The management of land resources and the side effects of high-productivity technology are not separate problems. Both require an agricultural policy that has ecological eyes. This ecological orientation must be reflected in agricultural research and extension programmes, the provision of irrigation and other infrastructure, taxes and subsidies on inputs and outputs, land tenure reforms, regulations governing land and water use, controls on inputs, and other elements of agricultural policy. The objective must be to match land use with land capability and to encourage cultivation

practices that protect and conserve land and water resources.

75. Resource base pressures arising from crop production will be matched by those that arise from animal husbandry and fisheries. If developing countries are to attain the protein consumption standards of the developed world, their production of protein-rich food will have to increase by a factor of four-and-a-half by the year 2000.^{14/} A part of this will be met by vegetable protein, but a substantial share will have to come from meat, milk, and fish. The ecological constraints on increasing the cattle population are perhaps even more acute than on crop production, particularly in Asia. Here, too, the focus will have to be on productivity increases through better feeding practices, selected breeding, and similar measures, combined with a shift to meat products like pork and poultry that require less land.

76. With regard to fish, the growth potential of marine resources appears to be limited; the best that can be hoped for is an increase from about 75 million tonnes at present to about 100 million tonnes by the year 2000.^{15/} Since this is clearly insufficient to meet rising demands, an increasing proportion of supplies will have to come from aquaculture, the deliberate production of fish under controlled conditions. As with agriculture, a policy framework is needed where every element serves the objectives of both growth and resource conservation.

77. Pressures on forest resources arise from a variety of sources. Forest clearance for shifting cultivation, resettlement schemes, or rangeland development for ranching has to be managed through an agricultural policy with an ecological orientation. Demand for timber and woodpulp has to be managed by a forestry policy that

I work with rubber trees in the Amazon. I am here to speak about the tropical forest.

We live from this forest they want to destroy. And we want to take this opportunity of having so many people here gathered with the same objective in mind to defend our habitat, the conservation of forest, of tropical forest.

In my area, we have about 14-15 native products that we extract from the forest, besides all the other activities we have. So I think this must be preserved. Because it is not only with cattle, not only with pasture lands, and not only with highways that we will be able to develop the Amazon.

When they think of falling trees, they always think of building roads and the roads bring destruction under a mask called progress. Let us put this progress where the lands have already been deforested, where it is idle of labour and where we have to find people work, and where we have to make the city grow. But let us leave those who want to live in the forest, who want to keep it as it is

We have nothing written. I don't have anything that was created in somebody's office. There is no philosophy. It is just the real truth, because this is what our life is.

Mr. Aragoja
Rubber-tapper
WCED Public Hearing
Sao Paulo, 28-29 Oct 1985

emphasizes controlled exploitation and regeneration. Pressures from fuelwood needs have to be met by local fuelwood forestry schemes and by encouraging a shift to other fuel sources, particularly in urban areas.

78. Arguably, the ultimate limits to global development are determined largely by the availability of energy resources and by the biosphere's capacity to absorb the by-products of energy use.^{16/} All current indications suggest that this energy limit may be approached far sooner than the limits imposed by other material resources. The point can be illustrated with a simple calculation. Assuming that per capita consumption in developed countries stops growing altogether and that the Third World reaches the 1950 European level of per capita consumption over the next 40 years, an "oil crunch" would

emerge by the first quarter of the next century. Nor can the gap be easily covered by other sources (see Box 2-2).

BOX 2-2

The Energy Crunch

1. The energy problems of the next century, given current patterns of energy use, can be shown with a simple calculation of energy requirements. These calculations do not purport to indicate what will happen. They only illustrate the implications of what could be considered minimal increases in energy requirements.

2. The analysis is restricted to what are described as commercial sources of energy - coal, oil, natural gas, and electricity. Energy requirements are calculated on the assumption that per capita consumption of commercial energy in developed countries would remain at the present level of 5.6 tonnes of coal equivalent. This implies gains in energy efficiency, measured as the ratio of energy consumption to gross domestic product, equal to the rate of per capita income growth. In developing countries, the calculations assume that the level of per capita consumption of commercial energy would rise from about 0.5 tonnes to 2.0 tonnes of coal equivalent by 2025. This would match the per capita consumption in Europe in 1950 and be below the level that prevailed in North America in the 1920s. The projected level of consumption in developing countries implies per capita consumption growth of 3.5 per cent per year and, given the expected rate of population growth, an overall rate of growth of 5.5 per cent falling to below 5 per cent by 2025.

3. Under these assumptions, the consumption level in 2025 would be about 21 billion tonnes of coal equivalent, some two-and-a-half times today's level. The cumulative consumption over the next 40 years would amount to about 540 billion tonnes of coal equivalent.

4. Are the fossil fuel resources required to sustain this consumption available? Some 40 per cent of commercial energy consumption today is in the form of liquid fuels. If urbanization and the widening ownership of motor vehicles maintains this ratio, the world will require around 1,000 billion barrels of oil over the next 40 years. Current reserves are around 700 billion barrels and the estimates on what remains to be found range from 350 billion to 1,150 billion barrels. At the lower limit, all the oil available would be used up completely in the next 40 years; at the upper limit, this point could be postponed by a couple of decades. Even if the absolute level of oil consumption is maintained at the current

(Box 2-2 continued)

level, proven and estimated reserves of oil would not last more than 90 years or so.

5. In principle, the "oil crunch" can be postponed by a shift towards natural gas, coal, nuclear power, and a variety of renewable energy sources. Proven reserves of natural gas are of the same order as those of crude oil, and an increase in the current rate of use could at best postpone the oil crunch by a decade or so. The rate at which nuclear power can be developed is limited by high costs and public concern about problems of waste disposal, safety, and hazard management.

6. The volume of coal resources is vast and can last for many centuries. Does the answer then lie in a shift towards coal? If oil and gas consumption in 2025 were kept at current levels and the balance of fossil fuel requirements were met by coal, around 15 billion tonnes of coal would need to be produced then, more than five times the current level. Cumulative production over the next 40 years would be of the order of 300 billion tonnes. This raises two points. First, is such an increase feasible? Though coal resources are large, only 400 billion tonnes are accessible in proven deposits that can be exploited over the next 20 years or so. Thus the scenario calls for an extremely intensive exploitation of existing mines and a major effort to develop new ones, both of which may be difficult given the high level of development costs and environmental impact of coal mining. The second point relates to the impact on carbon emissions from fossil fuel burning. This scenario implies a tripling of current levels; the impact of this on the concentration of "greenhouse" gases may well be unacceptable.

7. Renewable sources are the most acceptable ones from an ecological point of view. Including fuelwood, the current rate of use is on the order of 2 billion tonnes of coal equivalent, mainly in the form of hydropower. The long-term potential is for some 11 billion tonnes of coal equivalent. This must be compared with the calculation of "minimal" annual requirements of 21 billion tonnes by the year 2025. Hence even the full development of renewable energy sources would still require the continued use of fossil fuels and nuclear power if the level of demand grows as projected in these calculations.

Source: WCED analysis based on current consumption data in UNCTAD, Energy Tables; on oil reserve estimates in L.R. Brown et al., State of the World - 1986 (New York: W.W. Norton, 1986); and on current use of renewables data in D. Deudney and C. Flavin, Renewable Energy: The Power to Choose (New York: W.W. Norton, 1983).

79. Even this scenario implies a nearly threefold increase in the carbon emissions from fossil fuel burning. The likely impact of increased carbon-dioxide concentrations in the atmosphere and the consequent effects on global temperatures and sea levels may well be unacceptable. Some of these problems of resource exhaustion, carbon emissions, and pollution can be met by increasing the use of renewable energy sources such as biomass, hydropower, solar energy, and geothermal energy. But their long-term potential, as presently assessed, can at best meet the current level of total energy demand.^{17/} Moreover, the exploitation of renewable sources like fuelwood and hydropower also entails ecological problems. Nuclear power, another alternative to fossil fuel use, poses major environmental problems of radioactive waste disposal and safety, with a high potential for transnational effects.

80. Meeting energy needs will clearly pose major problems for resource conservation and environmental management. Sustainability requires that these trends be modified so that a growing proportion of energy requirements are met by renewable sources. But in addition, policy measures are necessary to modify the present pattern of energy demand. In the Third World, this means that a simple duplication of the life-styles and technological features of the developed economies is neither feasible nor desirable. This affects policies on urban development, the location of industries, housing design, transportation systems, and the choice of agricultural and industrial technologies. Developed countries must also recognize that their energy consumption is placing a major pollution load on the biosphere and eating into scarce fossil fuel supplies. Recent improvements in energy efficiency and a shift towards less energy-intensive sectors have helped to limit

energy consumption. The process needs to be pushed further to reduce per capita consumption and encourage a shift to non-polluting sources and technologies.

81. The availability of non-fuel mineral resources appears to pose fewer problems. Studies done before 1980, which assumed an exponentially growing demand, did not envision a problem until well into the next century.^{18/} And since then the world consumption of most metals has remained nearly constant, which suggests that perhaps the exhaustion of non-fuel minerals is even more distant. The history of technological developments also suggests that material scarcity can be adjusted to through greater efficiency in use, recycling, and substitution for scarcer substances. A more immediate problem is how to modify the pattern of world trade in minerals both to allow mineral exporters a higher share in the value added from mineral use and to improve the access of developing countries, whose material demands will increase, to mineral supplies.

82. The prevention and mitigation of air and water pollution will remain a critical task in resource conservation. Air and water quality come under pressure from a variety of activities, the more prominent being fertilizer and pesticide use, the sewage load from urban areas, fossil fuel burning, the consumption of certain types of chemicals, and various industrial activities, particularly those involving the treatment and transformation of basic raw materials. On present trends, the pollution load on the biosphere can be expected to increase substantially from each of these activities.

83. In developed countries, many pollution-intensive activities have reached some sort of ceiling, and the focal points of growth in these activities have shifted to the Third World. The greater part of the increase in fertilizer and pesticide use, in urbanization, in the

burning of fossil fuel, and in the production and consumption of basic chemicals, paper, and basic metals will take place in developing countries. The increase in pollution-intensive activities there will generate local and regional air and water pollution problems. Cleaning up after the event is an expensive solution, even for rich countries. This suggests developing countries need to immediately implement such measures as establishing and enforcing minimum emission standards, arranging to monitor air and water quality, promoting low-waste technologies, controlling more strictly the introduction and use of chemicals and synthetics, and avoiding industrial concentrations that overtax the absorptive capacity of the local environment.

7. Reorienting Technology and Managing Risk

84. The fulfilment of all these tasks will require the reorientation of technology - the key link between humanity and nature. Technological development has always been at the root of economic growth and accompanying social changes, raising productivity and altering social organization in all spheres of human activity. As it embodies a conversion of natural systems to human and social ones, it inherently alters and modifies the environment. With the ever-quickenning pace and pervasiveness of change in highly sophisticated technological societies, new risks and more destructive aspects of technology have come to the fore in the form of various types of environmental degradation, some of which threaten to exceed the outer limits of the life-sustaining systems of the earth. Thus, the conventional notion of linear technological "progress" has become suspect, and technology itself is now considered a risk factor.

85. In addition, an enormous gap exists between technological achievements and the ability to harness them to address problems of critical importance. The number of scientists, engineers, and technicians engaged in research and development (R&D) per 10,000 inhabitants is around 50 in the socialist countries of Eastern Europe, 28 in the developed market economies, and only 2.5 in the Third World.^{19/}

86. The worldwide predominance of technologies designed and generated in developed countries has yielded technologies not necessarily suited or easily adaptable to specific socio-economic and environmental conditions of a particular country, especially less industrialized developing ones. To compound the problem, the bulk of world R&D efforts and resources are not geared to addressing many of the pressing issues facing most developing countries, such as problems of arid land agriculture or the control of tropical diseases. Moreover, a disproportionately small effort is currently being devoted to adapting recent innovations in materials, technology, energy, conservation, information technology, and biotechnology to the needs of developing countries.

87. A substantial part of technological research is undertaken by commercial organizations whose orientation can lead to narrow R&D efforts devoted only to product and process innovations and to improvements that have market value. Technologies need to be developed that produce "social goods", such as improved air quality or increased product life, or that resolve problems normally outside the cost calculus of individual enterprises, such as the external costs of pollution or waste disposal. The role of public policy is to ensure, through incentives and disincentives, that they find it worthwhile to take fuller

One of the constraints towards the means of change, to improve the plight of the poor people, is to provide them with a voice, a political voice about what development is required, whether their basic needs are safeguarded, looked after, not from the perspective of the decision maker, but from the perspective of the object of the development: how to give them real participation in decision making.

So the point I want to make is that we cannot discuss environment and development without discussing political development. And you cannot eradicate poverty, at least not only with distribution of wealth or income, but there must be more distribution of power.

Aristides Katoppo
Director, Sinar Kasih
Publishing Group
WCED Public Hearing
Jakarta, 26 March 1985

account of environmental factors in the technologies they develop. Publicly funded research institutions also need such direction, and the objectives of sustainable development and environmental protection must be built into the mandates of the institutions that work in environmentally sensitive areas.

88. The world today is on the threshold of a technological revolution created by the emergence of several clusters of new technologies in widely disparate areas of scientific discipline. As they evolve over the next few decades, they promise to profoundly alter the way societies are organized in the next century. Though some of these technologies involve new types of risk, on the whole they appear to have rather positive effects on the environment, basically through the prevention, mitigation, or minimization of some of the adverse environmental impacts commonly associated with technologies in the past. The crucial task is to ensure the rapid development and diffusion of these new, environmentally more benign technologies.

89. The processes of generating alternative technologies, upgrading traditional ones, and selecting and adapting imported technologies should be informed by environmental and natural resource concerns. It is important, therefore, to improve such knowledge and capabilities where they exist and to create the conditions for them where they do not. This implies, among other things, important changes in educational patterns, and in national institutions and legal mechanisms, as well as the creation of ways to improve access to scientific and technological knowledge and international experience.

90. Developing environmentally appropriate technologies is closely related to broader questions of risk management. Many large-scale socio-technical systems such as nuclear reactors, electric and other utility distribution networks, communication systems, and mass transportation are inherently vulnerable if stressed beyond a certain point. Their connections through networks tends to make them immune to small disturbances but more vulnerable to unexpected disruptions that exceed a finite threshold. Applying sophisticated analyses of vulnerabilities and past failures to technology design, quality assurance in manufacture, and contingency plans in operations can make the consequences of a failure or accident much less catastrophic and damaging to the environment.

91. The state of the art in vulnerability and risk analysis has not been applied consistently across technologies or systems. A major purpose of socio-technical system design should be to make the consequences of failure or sabotage less serious. There is thus a need to step up the search for techniques and technologies, as well as legal and institutional mechanisms, for safety design and control, accident

prevention, contingency planning, damage mitigation, and provision of relief.

92. Environmental risks arising from technological and developmental decisions impinge on individuals and areas who have little or no influence on those decisions. Their interests must therefore be taken into account.

Institutional mechanisms are needed at the national and international level to assess potential impacts of new technologies (and products that embody them) before they are widely used, in order to ensure that their production, use, or disposal do not overstress the environment and natural resources. Similar arrangements are also required for major developmental interventions in natural systems, such as river diversion or large-scale forest clearance. In addition, liability for damages from unintended consequences must be strengthened and enforced.

8. Merging Environment and Economics in Decision Making

93. The common theme throughout this strategy for sustainable development is the need to integrate economic and ecological considerations in decision making. This will require a change in attitudes and objectives and in institutional arrangements at every level. Economic and ecological concerns are not necessarily in opposition. For example, policies that conserve the quality of agricultural land and protect forests improve the long-term prospects for agricultural development. An increase in the efficiency of energy and material use not only serves ecological purposes but can also help reduce costs. But the compatibility of environmental and economic objectives is often lost in the pursuit of individual or group gains with little regard for the impact on others, with a blind faith in science's ability to find solutions, and in ignorance of the distant

consequences of today's decisions. Institutional rigidities add to this myopia.

94. Ecological and environmental factors are most often neglected when people lack alternatives. A major task of development policy is to widen the options available for earning a sustainable livelihood, particularly for resource-poor households and areas under ecological stress. In a hilly area, for instance, economic self-interest and ecology can be combined by providing an infrastructure for the cultivation and marketing of tree crops that allow farmers to shift from grain production. Similarly, measures to protect the incomes of primary producers against short-term price declines may lessen their need to overexploit their resource base.

95. But this approach cannot ensure that the impact on resources not under individuals' control or on the health and well-being of other households will be taken into account. Sustainability requires the enforcement of such wider responsibilities, involving changes in the legal and institutional framework that will enforce the common interest.

96. Some necessary changes in the legal framework start from the proposition that an environment adequate for health and well-being is a fundamental right of all human beings - including future generations. (See Chapter 12.) Such a view places the right to use of public and private resources in its proper social context. Specific enactments and enforcement measures may be required on the right to discharge effluents into public bodies of water and the atmosphere, traditional rights of access to common property, the degree of freedom with regard to resource use, and liability for damage caused. In this way a comprehensive set of environmental laws and regulations

The issues which have been brought forward here, I think, are wide-ranging and maybe you know, maybe you don't know, the answers to all those issues. But at least by hearing all those questions, stories, all these expressions that have been put forward, at least you could have some idea.

You don't know the answers nor the solutions, but you could suggest the way to solve many problems and this is by suggesting either to governments, or the UN, or international agencies, to solve any problem the best way: that is to include those with direct interests in it. The beneficiaries, as well as the victims of any development issue should be included, should be heard.

I think that is the one thing, maybe that all of us are hearing here, or expecting: that in every development planning or development issue as much as possible to listen and to include, to consult the people concerned. If that is taken care of, at least one step of the problem is resolved.

Ismid Hadad
Chief Editor, Prisma
WCED Public Hearing
Jakarta, 26 March 1985

can be developed and integrated with other formal and informal laws and regulations.

97. The common interest cannot be enforced by the law alone; it also requires community support, which can best be secured by greater public participation in the decisions that affect the environment. This is most easily secured when control over resources is decentralized, entailing effective community control over some individual decisions on resource use. In some cases, however, technology involves large-scale projects that require participation on a different basis. Public inquiries and hearings on the developmental and environmental impact can help greatly in drawing attention to different points of view. Free access to relevant information and the availability of alternative sources of technical expertise can provide an informed basis for

public discussion. When the environmental impact of a proposed project is particularly high, public scrutiny of the case for and against should become mandatory and, wherever feasible, the decision should be subject to prior public approval, perhaps by referendum.

98. But it is not enough that decision makers are exposed to public review. A change of attitudes and procedures is required in both public and private sector enterprises. Moreover, environmental regulation must move beyond the usual menu of safety regulations, zoning laws, and pollution control enactments; environmental objectives must be built into taxation, prior approval procedures for investment and technology choice, foreign trade incentives, and, in fact, all components of development policy.

9. Strengthening International Cooperation

99. The integration of economic and ecological factors into the law and into decision-making systems within countries has to be matched at the international level. With the growth in fuel and material use, direct physical linkages between ecosystems of different countries will increase. Economic interactions through trade, finance, investment, and travel can also be expected to grow and thereby heighten the economic and ecological interdependence between countries. Hence in the future, even more so than now, sustainable development requires the unification of economies and ecology in international relations.

100. The principal changes required in international relations are similar to those in domestic decision-making systems. In the international economic field, far-reaching changes are required to produce trade, capital, and technology flows that are more equitable and also reflect environmental imperatives. Immediate international action to resolve the debt crisis in a manner that permits a resumption of more rapid development, a substantial increase in the flow of development finance, and stabilization of the foreign exchange earnings of low-income primary product exporters will help stem the deterioration in economic and social conditions. Long-term sustainable growth will require international action on market access, technology transfer, and international finance to help developing countries diversify their economic and trade base and build up self-reliance.

101. In international relations as in domestic policy, environmental objectives cannot be pursued separately. The unification of economics and ecology will proceed far more easily if environmental factors are part of the objectives of such regional and international organizations as the multilateral development banks and financial organizations (e.g., the World Bank and IMF), the agencies involved in trade negotiations (e.g., GATT and UNCTAD), and specialized agencies (e.g., FAO, UNIDO, and WHO).

102. The growth of ecological interdependence also requires the effective articulation of common interests in a regional or global environment. Regional and international cooperation are going to be essential in all the areas of current threat to critical life-support systems that are listed at the end of Chapter 1. The basis for regional and international cooperation must be

provided by the development of an international law on these matters and of effective procedures and institutions for implementing it. The Law of the Sea, agreements on some international water bodies, targets for reduced sulphur emissions by some developed countries, and the international convention on endangered species are all examples - however imperfect - of such an approach. They need to be strengthened and built upon.

IV. CONCLUSION

103. In its broadest sense, the strategy for sustainable development aims to promote harmony between human beings and between humanity and nature. In the specific context of the developmental and environmental crises of the 1980s, the pursuit of sustainable development requires:

- * a political system that is democratic and that secures effective citizen participation in decision making,
- * an economic system that is able to generate surpluses and technical knowledge on a self-reliant and sustained basis,
- * a social system that avoids the tensions arising from disharmonious development,
- * a production system that respects the obligation to preserve the ecological base for development,
- * a technological system that can search continuously for new solutions,
- * an international system that fosters sustainable patterns of trade and finance, and
- * an administrative system that is flexible and has the capacity for self-correction.

104. These requirements are undoubtedly stringent, and to expect all of them to be achieved in full measure may be unrealistic. Fortunately, the survival and development of human societies does not require such perfection. These requirements are more in the nature of goals that should underlie national and international action on development. What matters is the sincerity with which these goals are pursued and the effectiveness with which departures from them are corrected. In this sense, sustainable development is a process of learning and adjustment rather than some ultimate state of complete harmony.