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ENVIRONMENT-DEVELOPMENT CONNECTION

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CHAPTER 2

THE ENVIRONMENT AND DEVELOPMENT CONNECTION

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CHAPTER 2

THE ENVIRONMENT-DEVELOPMENT CONNECTION

A. INTRODUCTION

1. Economic growth is often defined in terms of increases in production and the processes of development are thought of as a way of increasing the flow of inputs required to bring about such increases. However development is a wider concept and involves not merely quantitative increases in production but also changes in economic structure, societal organization and cultural values. The physical environment impinges on growth and development because the flow of productive inputs is constrained by the stock of resources and the processes of production and consumption necessarily generate wastes.
2. A wider conception of the development process integrates developmental and environmental considerations. Thus food production and a deteriorating land base, fertiliser use and nitrate pollution, the burning of fossil fuels and air pollution, the growth in material use and resource scarcities become parts of the same problems, the effects of the same causes. Such an

integrated view is essential for finding sustainable solutions not merely for environmental problems but also for developmental questions.

3. Many of the environmental stresses that we experience are not new and have arisen, in various forms in the past and have their roots in long-term developmental trends. This may suggest that today, as in the past, these problems can and will be solved one way or another. But we must recognise that, often, past "solutions" involved vast misery. They depended on great inequalities in the power structure which could transfer environmental costs from one group to another. These brutal "solutions" are clearly not the answers we seek today. Moreover there are thresholds beyond which the scale of impact changes in a dramatic fashion, for instance in the process of deforestation or air and water pollution. We are much closer to many of these thresholds than we have ever been in history. The risks of ecological damage that we face are now no longer merely local but global. The gentler, less brutal, solutions we need will require basic changes in our paths of development changes that will have to be based on a clearer understanding of the environment-development connection.

Boxes on:

- (a) Collapse of Mesopotamian civilization;
- (b) How population pressures in 19th century Europe were managed by emigration, etc.

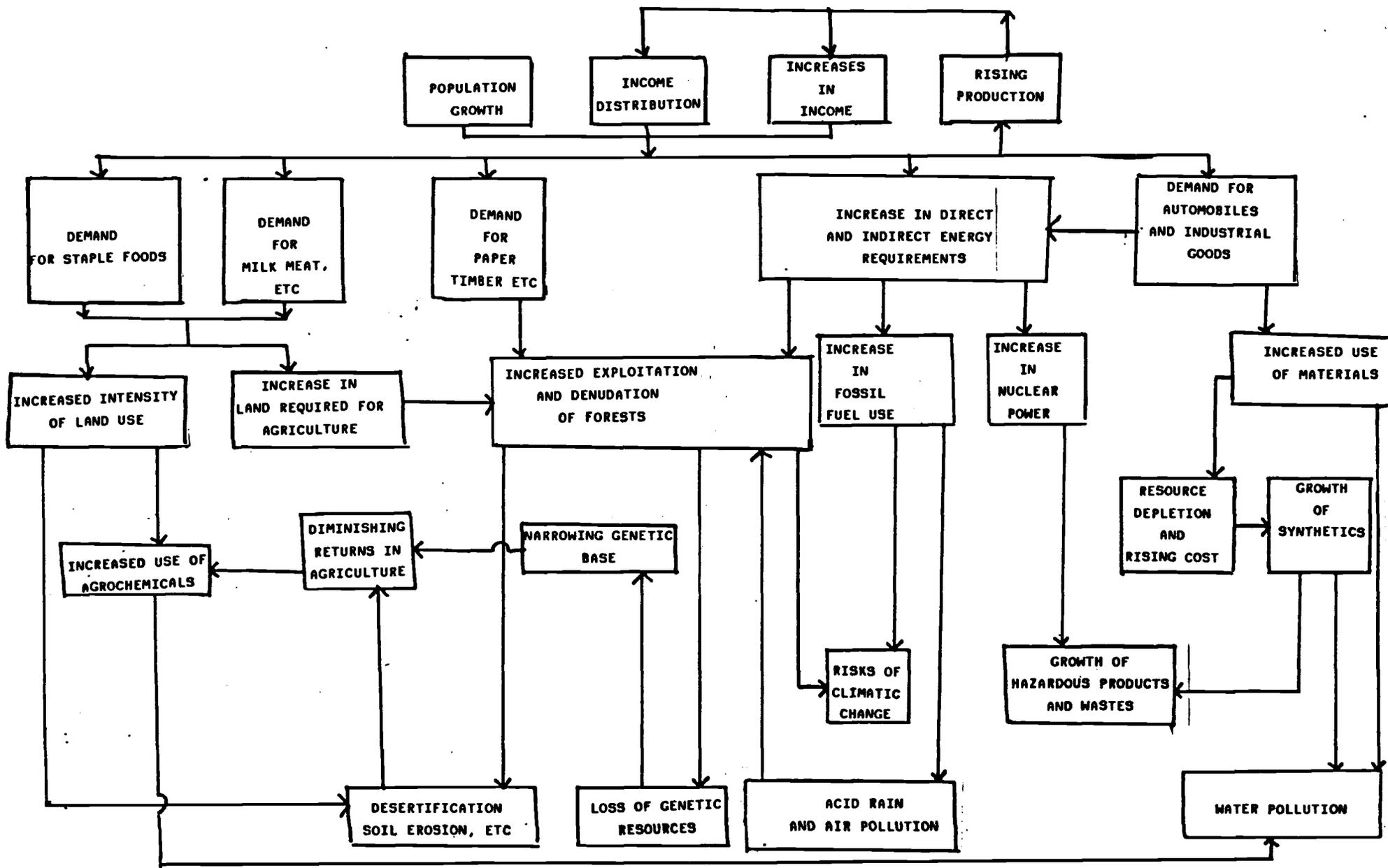
B. GROWTH, DEVELOPMENT AND THE ENVIRONMENT

4. The processes of economic growth and population expansion are a source of pressure on the natural environment and, conversely, environmental stresses constrain the possibilities of growth and development. However these relationships are not fixed. Much depends on the content of growth, on the type of technology used and on the manner in which the crucial linkages are managed. A synoptic picture of some but not all of these linkages is given in Figure 2.1. The most important point about this chart is that the linkages between developmental and environmental variables operate in both directions and from sector to sector.

5. The logical starting point for describing the environment-development system is the growth in demand which arises from population growth and increases in purchasing power, both of which have been exceptionally high in the post-war world. From the point of view of the environmental impact there are five components of this increase in demand which are of particular importance:
 - (i) foodgrains and other staple foods;
 - (ii) milk products, meat and fish;
 - (iii) paper and other wood products;
 - (iv) automobiles and household appliances;
 - (v) energy in the form of electricity and petroleum.

FIG. 2.1

THE ENVIRONMENT DEVELOPMENT CONNECTION



Agriculture and Forestry

6. World consumption of cereals, which account for the major part of food intake, particularly in the developing world, more than doubled between 1950 and 1984. The two major factors underlying this increase are (a) in the developing countries, an increase in the direct demand for cereals because of population growth and income increases and (b) in the developed countries, rising requirements of grain for animal feed which accounts for one-third of world cereal consumption.

7. The food-population balance is critical both for development and for environment. At the global level food production has grown faster than population in the post-war period; but there are many regions where this is not the case and, where they happen also to be areas of poverty, the people in these regions lack the means to purchase the surpluses available elsewhere. Moreover in these and in more prosperous regions there often is a food-population imbalance in poor households. Many such households in developing countries are subsistence farmers who are unable to feed adequately the rising numbers of family members from the limited resources at their command. The principal difficulties posed by the acceleration in population growth rates are at this household and regional level and not so much in terms of a global imbalance. If the population of developing countries had grown at say 1 per cent rather than at over 2 per cent between 1950 and 1985 there would have been 1250 million fewer mouths to feed - which, at the average consumption level prevailing in the developing countries, would have reduced cereal demand by less than

20 per cent. However, a lower rate of population growth would also have meant fewer mouths to feed in poor households and poor regions and the gains from this could have been truly substantial.

8. Family size is determined to a large extent by social and cultural factors. But economic compulsions also play an important role. In peasant households with substantial land holdings family size may be large to provide labour for cultivation. In resource-poor households large family size may be a form of insurance for old age. In urban families family size may be smaller because the mother needs to work or because of the cost of living space. Because of these, and other similar linkages, demographic change is closely linked to the level and pattern of economic development. The developed countries went through their demographic transition many decades ago and have low population growth rates. The developing countries are still in the midst of transition. Mortality rates have fallen in all areas but a corresponding fall in birth rates is still to come. In general the densely populated countries of South and South-East Asia are further on the road to demographic transition than the less densely populated countries of Africa and Latin America.

9. The food requirements of the poor are not the only, perhaps not even the primary, factor underlying the increase in world food production. The rising demands of the more affluent are as important. However this increase was not so much for basic staple foods but for other food items like sugar, fats and oils, milk products, meat and fish. Since 1950 the world consumption of these has increased more than the direct

consumption of foodgrains. Even today the greater part of world consumption of these food items takes place in the developed countries.

10. The growth in food production in the post-war period is unprecedented in human history. It has helped the world to cope with the rising number of mouths to be fed. The moot question however is whether these increases can continue and, even, whether they can be sustained.
11. A part of the post-war growth is due to the expansion in the area under cultivation mainly in the developing countries of Asia, African and South America which in the case of foodgrains has been a little over 50 per cent in the past three and a half decades. A substantial part of the pressure on land has arisen from subsistence farmers whose food requirements have gone up because of rising population. In many forest areas the cycle of shifting cultivation has shortened to such an extent that the forests are being destroyed. In many dry areas cultivation is being extended to marginal lands. In many hill areas crop cultivation is being undertaken on steep slopes with increasing risks of soil erosion. In many river valleys, areas chronically liable to floods are now being used for agriculture. Much of this pressure from subsistence farmers arises because the best land is in the hands of larger commercially oriented farmers.
12. The pressures arising from commercial agriculture are of a different nature. In the nature of things a profit or production maximising farming unit will not extend cultivation to low productivity lands. However commercial pressures can and often do lead to inappropriate cropping patterns and practices. In many cases official policies, particularly those relating to agricultural subsidies, have reinforced this tendency.

Sugarcane is often cultivated in irrigated areas where the water is better used for other crops; land which should be used for tree crops is given over for field crops, the variety in the cropping pattern may be greatly reduced. Commercial pressures also lead to a more intense use of the land with a reduction in fallow periods and the pressure to maximise yields lead to high levels of fertiliser and pesticide application and inappropriate water use.

13. The impact of agricultural expansion on forest cover is one major source of resource-stress in the developing countries. In tropical Asia, 1.8 million hectares of closed forest were deforested every year between 1976 and 1980 mainly for the expansion of crop cultivation. In many cases this arose from official programmes of planned transmigration to relieve the pressure on land elsewhere. Similar processes are at work in Latin America, particularly in Amazonia. The pressure from shifting cultivation is a major factor in Africa and Latin America. Worldwide ranching is estimated to deforest about 2 million hectares every year, the bulk of this being in Latin America. One of the factors behind this conversion has been the need for cheaper sources of beef to meet the demand for fast foods in the USA. In many areas the trees which protected cropped areas from wind erosion have disappeared.

14. The pressures from subsistence food production, commercial crops and meat production also underlie the processes of desertification. About 29 per cent of the earth's land area is subject to varying degrees of desertification, slight, moderate and severe, and an additional 6 per cent is classified as extremely severe. The area degraded to desert-like conditions continues to grow at 6 million ha annually. The

countries most severely affected by desertification are in the Third World, the worse hit being those in the Sahelian-Sudano zones of Africa.

15. The pressure on land quality is not limited to marginal areas. In many agriculturally prosperous regions the intensification of agriculture is leading to massive losses of top soil. Commercial pressures and the compulsions of mechanisation lead to single-crop cultivation and the abandonment of crop-rotations that could maintain the binding capacity of the soil. Irrigation is a major factor making for agriculture prosperity but half of all irrigation schemes face problems of salinization, alkalization and waterlogging which is leading to the abandonment of some 10 million hectares of irrigated land annually. In many irrigated areas, excessive groundwater withdrawals have led to a lowering of the water-table. The decline on land productivity is often sought to be corrected by increasing application of fertilisers and this has led in some areas to the nitrate pollution of water bodies. The growing dependence on a single crop, often a single seed variety, has increased the potential loss from pest attacks and led to a growing use of pesticides and the consequential problems of pest resistance and pesticide poisoning.

16. The new seed-fertilizer technology which underlies the spectacular increase in agricultural productivity, developed in response to the specific compulsions of agriculture in the developed countries and was focussed as much at economizing on labour as on improving land productivity. Its successful application required a base of scientific and technological skills, a developed

system for technology extension and other services for farmers and a high degree of commercial orientation in farm management. In the developing world the new technology worked where these pre-conditions could be created; but this could not be done everywhere.

17. Inequalities emerged as ecologically disadvantaged areas and land poor rural masses could not benefit from these advances, and governments in most developing countries were unwilling or unable to correct this through redistributive measures. As a consequence, despite rising food production, hunger and malnutrition continued and, in some parts, even increased. At the global level the gap in agricultural technology widened. For instance, the average level of foodgrain productivity in Africa in relation to European productivity declined from roughly one-half to about one-fifth over this period. Even in Asia, where the new technology spread particularly rapidly, productivity in relation to European levels declined. Similar "technology-gaps" have emerged within countries.
18. The environmental hazards posed by the new agricultural technology can be managed and contained with appropriate policies. The difficulty is that in the search for quick production increases and short-term profit these so-called "side-effects" are ignored. But even more than this, the truly difficult problems lie in the agricultural systems that are outside the mainstream of commercial development in marginal areas and marginalised households.

19. The impact of agricultural expansion on forest-cover has been described earlier. But the pressure on forests also arises from other sources. The growth in the demand for paper and timber is one major factor. World consumption of paper has grown nearly fourfold since 1950 and amounts to about 165 million tonnes at present. The greater part of this is consumed in the developed countries, but with rising incomes, growing literacy and an expanding population the demand for paper in the developing countries is increasing rapidly.

20. Similar pressures are at work in timber production. The rising demand for tropical timber has led many countries endowed with large forest resources over-emphasize the timber harvest, largely for export but also for local industries, at the expense of other potential benefits. A case in point is Ivory Coast which between 1965 and 1972 assigned more than two-thirds of its productive forests to concessionaries. By 1985 that country's forests were only 22 per cent of their extent in 1955. Though to a lesser extent, other countries such as Indonesia, the Philippines, Ghana have witnessed accelerated deforestation through exploitation for timber.

21. Another source of pressure on forests has arisen not so much from rising incomes as from rising population and that is the demand for fuelwood. In 1980, the FAO estimated that 100 million people in the Third World were not able to satisfy their minimum fuelwood needs. At the same time the minimum energy needs of a further 1,050 (mainly urban) were being met through overcutting the wood resources. As forests recede rural people,

especially women, have to walk several kilometres a day in search of fuelwood. The burden this places on them is dictating the number and quality of their meals and threatens nutritional security. In some cases, they are using biomass as a source of domestic energy, depriving food production of this input.

22. Forests play a major role in the stability of the worlds ecosystems and the loss of forest cover is leading to a high degree of environmental stress in many areas. An increase in the run-off of rainwater, soil erosion, landslides, siltation of reservoirs are some of the effects that can be seen. But besides these physical effects the loss of forests is destroying the livelihood base of many forest-dwellers who, over the centuries, have developed a way of life that uses the forest but does not destroy it. Nor are the effects of deforestation only local in character. A large-scale loss of forest cover could contribute to global climatic change. Another effect with a global impact is the loss of plant and animal species, a matter for particular concern in the case of tropical forests.
23. The environment development connection in agriculture and forestry is very much a two-way link : rising demands lead to rising production but in a manner that erodes the resource-base and thus endangers the very basis for the increased production. Moreover the process works in such a way that though the requirements of the affluent are met, the livelihood base of many poor producers is destroyed or severely reduced and this, in turn, leads to a further pressure on the resource base.

Industry and Energy

24. The environment-development connections which arises from the rising demands for energy and manufactured goods are a little different. The resources concerned are predominantly non-renewable and the environmental effects generated are of concern not so much because they erode the productive potential of the resource base but because of their wider effects on health and property. But even here the central issue is the long-term sustainability of the vast increases in production in the post-war period.
25. At the global level the consumption of commercial energy increased more than threefold between 1950 and 1983. In the developed countries the greater part of the increase in consumption took place before the mid-seventies and arose to a large extent from the massive increase in the demand for automobiles and modern household appliances. Thirty years ago the ownership of these consumer durables was widespread only in the USA; but since then this phenomenon has spread to virtually all the developed countries and urban elites in many developing countries. In _____ the consumption of motor gasoline (used mainly in passenger cars) and residential energy demand accounted for _____ per cent of energy consumption in the developed market economies. With the growth in industrial production and the rising importance of energy use in agriculture, the indirect demand for energy has also grown rapidly, particularly in the developing countries.

26. The use of energy is not evenly spread between or within nations and much of it is concentrated in major urban centres. The burning of fossil fuels necessarily produces carbon monoxide, sulphur dioxide, nitrous oxides, etc and during the past three decades of rapid growth, urban air pollution has increased dramatically, more or less in pace with fossil fuel consumption. The primary impact of this deterioration in air quality is on health and some areas, where the problem is acute, this impact is substantial enough to endanger life. Air pollution may well affect the production process through its impact on worker health, absenteeism, etc. However the real issue is not this but its impact on the well-being of the whole population.

27. The impact of air pollution is not merely local in character. During long distance transport in the atmosphere, emissions of sulphur oxide, nitrogen oxide and volatile hydrocarbons which arise mainly from fossil fuel combustion are transformed into sulphuric and nitric acids, ammonia salts and ozone. They fall to the ground, sometime thousands miles from their point of emission, as dry particles or in rain, snow, frost, fog and dew. Silently accumulating over the decades, the damage to the environment first became evident in Scandinavia in the sixties and has since mounted at an accelerating pace.

28. Acidification has a very direct impact on productive resources. Several thousand lakes in Europe and North America have registered a steady decrease in pH levels to the point where they no longer support fish life. The same acids attack stonework and corrode metal

structures causing billions in damage annually. It enters drinking water supplies, liberates potentially toxic metals such as cadmium, lead, mercury, zinc, copper and aluminium, and poses risks to human health. Up to now, the greatest damage has been reported over Eastern and Western Europe, which are currently receiving more than one gramme of sulphur on every square metre of ground each year. There was little evidence of tree damage in Europe in 1970, but as of now an estimated 5-6 per cent of all European forest land is affected. Evidence of acidification in some newly industrializing developing countries is now beginning to emerge

29. The use of fossil fuels is one of the factors underlying the possibility of climatic change. Upon combustion, fossil fuels emit the gas carbon dioxide, which accumulates in the atmosphere. The pre-industrial concentration was 280 parts of carbon dioxide per million parts of air (by volume - ppmv). This concentration reached 340 ppmv in 1980 and is expected to double (to 560 ppmv) between the middle and the end of the next century. Other gases are also accumulating in the atmosphere, principally, chlorofluorocarbons (used as aerosol propellants in spray cans and in refrigerators as a coolant); methane (rising from wet, reducing soils, e.g. rice-paddies, or from the earth's surface, especially where oil or gas is exploited); nitrous oxide (derived from the breakdown of nitrogenous fertilizers); and ozone (generated by industry and internal combustion engines).

30. The question of climate warming caused by rising concentrations of these "greenhouse" gases in the atmosphere has been the object of intense assessment, nationally and internationally and after reviewing the latest evidence in October 1985, scientists from 29

industrialized and developing countries concluded that climate change must be considered a "plausible and serious possibility". They estimated that the concentration of greenhouse gases in the atmosphere could lead to a rise in global mean temperatures in the first half of the next century "greater than any in man's history". The great concern, is that a global warming of 1.5 - 4.5^oC would lead the sea level to rise from 25 - 145 cm, which would inundate low lying coastal cities and agricultural areas, and many countries could expect their economic, social and political structures to be severely hit. This would be accentuated by the effects of changing climate on inland crops, forests and ecosystems.

31. The rising levels of energy and industrial production are based on the use of non-renewable minerals and the possibility of resource exhaustion is a major source of concern nationally and internationally. Mineral reserves are by and large, proven and established only when demand conditions warrant it since detailed exploitation is expensive and undertaken only when the need for the resource is recognized. Hence geologists have developed the wider concept of "resources" which covers prognosticated estimates of reserves which could be established in future with sufficient exploration. In the limit the figure for "resources" could include the entire amount of the element in the earth crust, what geologists call 'crustal abundance'. But this is unrealistic since minerals have to be present in some minimum concentration for it to be geochemically possible to extract the element of interior and, more important, for it to be economically worthwhile to do so. A narrower concept of "resources" would take this into account. (Box on application of this concept).

32. The environmental debate has generated many calculations of the presumed lifetimes of various mineral resources at current or projected rates of use and, particularly when current proven reserves are used as the base, the calculations look alarming. However such calculations are misleading even if the wider "resources" estimate is used. Basically a resource will rarely if ever be completely expended since long before that the growth in supply will fall behind the growth in demand, scarcities will appear, become more severe and induce the production of substitutes. (Box on "lifetime" of various mineral resources).
33. Trend projections do not evaluate the consistency and sustainability of current patterns of industrial development which derive their logic from the pursuit of what could be described as the "consumer durable society". If the level of global consumption is defined by the average in the developed countries then world production of petroleum and metallic minerals would have to rise to over three times the present level. These requirements are very large in relation to prognosticated "resources" and clearly certain major adjustments in the material basis for industrial production will become unavoidable sooner or later.
34. The history of technological developments suggests that such adjustments are possible. First the day of reckoning can be postponed by greater efficiency in use and a greater effort at recycling of materials. But more importantly the range of materials used can be widened and substitutes for scarcer substances developed, e.g. plastics for non-ferrous metals. It has been estimated that the number of elements used by man

has increased from 19 in antiquity to around 28 on the eve of the Industrial Revolution, 59 in the early 20th century and 80 as of now. The modern science of materials holds the great promise of replacing scarce metals by vastly more abundant ceramics and glasses. In energy technological options for the replacement of fossil fuels are available and major gains in conversion efficiency are feasible. In a future world of scarcity a command over these newly emerging technologies may be a greater source of strength than the ownership of mineral resources.

35. The possibility of resource scarcity is one, but not the only, factor underlying the development of nuclear power which has created a new environmental problem of radioactive wastes. The spent fuel inventory of the 285 operating reactors in the market economies has risen ninefold since 1970 and amounts today to 56,600 tonnes of heavy metal. There are another 60 operating reactors in the socialist countries with a substantial but unknown radioactive spent fuel stocks.
36. The problems of hazardous wastes is also linked to the rapid growth of the chemical industry, which also was stimulated at least partly, by the search for synthetic substitutes for natural materials. Another factor in the development of the chemical industry is the rapid rise in the demand for agro-chemicals. Today large numbers of new chemicals are put onto the market with very inadequate prior testing of their effects on human beings, animals, plants and natural systems. The impact of chlorofluorocarbons on the ozone layer have been mentioned earlier. There are other problems arising often from the fact that many new chemicals enter living

systems but are not biodegradable. A classic case is the persistence of DDT in living tissue and its accumulation to critical levels as we move higher up the food chain.

37. Water is a major input in the production of energy and industrial products. In Europe and North America the use of water for such purposes has grown roughly four-fold since 1950 and accounts for one-half of total water-use. The quantity of water used by industry in these two continents is six times greater than the water used for drinking, sanitation and other household purposes. Only a small part of this water is used up and the bulk of it is returned to rivers, lakes and local seas. But the water that is returned is not unchanged and carries with it a load of thermal pollution, noxious chemicals and a variety of other substances that reduce greatly the value of the river or lake or local sea for other uses. The growing amounts of urban wastes and the nitrate and phosphate laden run-offs from agriculture have compounded this problem. The pollution of water bodies leads not merely to a loss of amenity but also to health damage, loss of fishing resources, a reduction in irrigation potential, etc.

Human Settlement

38. The changing structure of economic activity has led to major shifts in the distribution of population within countries. In the developed countries the major transitions have already taken place and the striking feature in recent years has been the deconcentration of urban areas in many developed countries and the shift of population to rural areas and smaller settlements. In

developing countries the transition is still under way. Between 1960 and 1980 the urban population in the developing countries increased by more than 500 million and a growing percentage is now residing in large cities of over 1 million. These cities attract migrants for a variety of reasons. One of these is the dominant role that these cities play in the national economy, particularly in the growth of modern industry and services. Another factor is the gradual erosion of the livelihood base in the rural hinterland because of population growth and ecological stress.

39. Urbanisation is a necessary consequence of the growing diversification of Third World economies and is not, in itself, undesirable. In fact, in many developing countries, this process may well be essential to reduce the pressure of population growth in rural areas. The real difficulty is that the pace of urbanisation is much faster than the capacity to cope in the formal structures of urban administration. Shortages of housing, water supply, sanitation and mass transit services are widespread. A growing proportion of urban populations live in slums, many of them in environmentally vulnerable areas exposed to air and water pollution and industrial hazards. In many a Third World metropolis there are in fact two cities. One is a city of the elites who derive their income from the more formally organized part of the economic systems and enjoy standards of housing, water supply, sanitation, road space and greenery comparable to, or even better than in a developed world city. The other is the city of the masses who derive their livelihood from a complex of informal economic activities, who derive little benefit from the formal structures of urban

administration and who meet their basic needs for housing, water supply, etc essentially through self-help.

40. The environmental problems of urban areas arise not just from the concentration and growth in population but from the nature of the economic base in many cities. The widespread use of motor vehicles and the burning of fossil fuels gives rise to the problem of air pollution. The growing awareness of the effects of polluted air on human health, property and the environment has led to control measures and reduced emissions of some of the principal pollutants and cleaner air over some cities. However many industrialized countries and virtually all developing countries have witnessed a steady deterioration in the quality of their air with all its attendant effects. Air pollution has reached dramatic levels in many major Third World cities like Sao Paulo, Rio de Janeiro, Buenos Aires, Lagos, New Delhi, Bangkok, Seoul and many others. Similar problems have arisen in the case of water and in many cities high concentrations of heavy metal have been found in drinking water supplies.

41. Problems of living space and a habitable environment are perhaps less acute in rural areas. The principal source of pressure there is population growth. Every year the rural areas of the Third World have to accommodate _____ million new households. In many countries the requirements are substantial enough to eat into agricultural land. Moreover with growing size many rural settlements are facing problems of drinking water supply, sanitation and even water pollution (e.g. from nitrates) which are similar in nature if not in magnitude to urban problems.

Limits to Growth?

42. The two-way interaction between environmental constraints and developmental possibilities have led to many assessments which put great stress on the physical limits to growth. Some early assessments argued strongly that available sources of energy, essential raw materials and food would run out and that these supply limits, along with overwhelming pollution, would inhibit and eventually halt economic growth. However the content of growth has changed and material demands are not increasing as rapidly as the early assessments suggested. Hence most recent assessments, have concluded that growth can continue for the foreseeable future without encountering fundamental limits at the global scale.
43. There is no one unique limit to growth. There are a variety of constraining factors and, amongst these resource limits are not necessarily the most important. Moreover the limiting factors may operate only in some regions though certain global limits cannot be ruled out. For example the capacity of the ecosystem to absorb emissions of carbon dioxide and several radiatively active trace gases may well be exceeded and climatic change, accompanied by a sea level rise is a "plausible and serious possibility" within 40 to 60 years, i.e. within the lifetime of today's young adults.
44. The content of economic growth and development has and will continue to confront ecological limits at the regional and local scale. As detailed in succeeding chapters, agro-ecosystems, watersheds, forests, inland waters, regional seas and human settlements in many countries, developed as well as developing have run into

these limits. Given the accelerating pace and pattern of growth projected through the middle of the next century, these constraints present a more immediate threat to needed development, and to a successful transition than any at the global level. These local and regional constraints present the greatest threat to development where it is most needed - in the Third World.

45. Ecological constraints, even when they can be mitigated by technology, or management, matter for another reason. Generally, as a system approaches such ecological limits there is a sharpening of inequalities. Thus when a watershed deteriorates a poor farmer suffers more because he cannot afford the ameliorative measures which a more prosperous farmer can. In cities when air quality worsens, the poor, who tend to live in more vulnerable areas, suffer more health damage than the rich who, even in extreme situations, can protect themselves by moving to more salubrious areas or installing air-conditioning. When mineral resources are depleted, late-comers to the industrialization process lose the benefits of low-cost supplies. Even with global effects, the wealthier nations are better placed financially and technologically to cope with the effects of possible climatic change.

46. Ecological constraints are intimately bound-up with institutional constraints. Where the content of current and projected development exceeds ecological limits, it does so often because institutional barriers prevent them being managed together. It is economic, trade, tax, fiscal, agricultural, energy, transport and other policies that most influence the content of

development. Yet, structural and other barriers usually ensure that they are ecologically blind. The greatest difficulty lies in the fact that the reality of ecological and economic interdependence is not reflected in the procedures for decision making and the framework of institutions and the most lasting solutions to environmental and developmental problems lie in measures which correct this.

C. INTERDEPENDENCE AND EQUITY

47. The processes of production and exchange are necessarily social in character. They involve not merely an interaction between the producer and the natural resources he uses but also amongst producers and between them and consumers. Moreover the developmental trends that were described earlier have, if anything heightened this interaction and widened its range from the local to the national, from the national to the regional and from the regional to the global. Yet the manner in which decisions are taken do not reflect this reality. There are basically three reasons for this inadequacy: (a) The absence of mechanisms to articulate the common interest, particularly at local level (b) the deepening of inter-sectoral linkages and (c) the growing role of the international economy.

The articulation of the Common Interest

48. Ecological interactions do not respect the boundaries of property ownership and political jurisdiction, a fact which has been recognized for centuries in the way in which societies organize their economic activities. 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. 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, the locus for decision-making shifted from the group to the individual. These processes completed long ago in the developed world are still under way in many of the developing countries.

49. 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 his neighbours in a direct fashion and many examples can be given to demonstrate this:
- In a watershed, the land-use patterns of a farmer up the slope directly affect run-off and other conditions in farm lower down;
 - The seed varieties, irrigation practices, pesticides and fertilizers used on one farm affect the productivity of neighbouring farms, a form of interdependence which 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 local fisherman.

50. The normal mechanisms of a market economy cannot take this physical interdependence into account, a fact widely recognized in economic theory when it deals with externalities, public goods and common property. Market systems price resources which are scarce and which can be privately appropriated, minerals for instance. But many resources do not fall into this category, air and public water bodies being prime examples. Such public resources tend to be treated as free goods and, in the absence of non-market intervention, they will be overused and abused at a great cost to the community. In a market system the individual producer and consumer are sovereign and, in the absence of regulations, free to decide without having to pay a price for the harmful effects of their decisions on others. Even in a planned economy the situation may not be much better if the modalities of plan formulation are based essentially on production efficiency at the enterprise level.
51. It is not that there are a set of villains and another set of victims. That may be the case in some instances. The more general situation is described by the "isolation paradox". Everyone would be better off if each one takes into account the effect of his decision on others. But each one is unwilling to assume that the others will behave in this socially desirable fashion and hence everyone continues to pursue a narrow self-interest. The only mechanism available to compensate for this isolation is the authority of the community or the government, local or national. Through command and control mechanisms, promotional programmes, taxes and subsidies, governments can try and enforce the common interest. Legislative standards and strict

liability legislation can enforce responsibility for harmful side-effects. But these are essentially "add-on" measures which act to regulate or compensate for what are, in effect, unwelcome developmental trends and unwise policies. There is often a "knowledge" gap in that traditional methods of technical and economic monitoring and analysis cannot reveal the facts of interdependence. But above all there is a "willingness" gap particularly when the measures required limit the gains of the local power structure.

52. Beyond the local level physical interdependence may not be as all pervasive but, with the growing scale and concentration of productive activity, there are, what could be described as large-scale externalities. Air moves horizontally and there are regional and even global pollution effects e.g. acid precipitation and the accumulation of carbon dioxide in the atmosphere. There are more than 200 international river basins and a large number of shared seas. Conflicts over the use of such shared resources and trans-border water pollution are common. The enforcement of common interest suffers in many such cases because there is often a large difference between the boundaries of political or administrative jurisdiction and the area of impact. Energy policies in one jurisdiction lead to acid precipitation in another. The emission of effluents into a river in one country leads to a emission of amenity in another. The fishing policies of one littoral state affects the catch of another. When such problems occur within countries an effective national government can connect the gap between area of impact and administrative jurisdiction.

But when the problem arises between nations there is no such supranational authority and the common interest can only be articulated through international co-operation.

53. The articulation of the common interest would perhaps be an easier matter if all developmental and environmental problems had solutions which would leave everyone better off. But this is seldom the case and there are gainers and losers. Many problems arise from inequalities in access to resources. An unequal structure of land ownership can lead to under use in the few large holdings and overuse in the many small 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 suboptimal 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 losses from developmental failures and environmental deterioration.

Inter-sectoral Linkages

54. The growth in physical interdependence between producers and consumers has been accompanied by a growing interaction between sectors of productive activity. Decisions about production, input use, product design, pricing, etc. in one sector impinge, more and more, on the options available in other sectors. The most direct manifestation of this is in the growth of inter-sectoral transactions by way of input purchase and output sale.

55. Traditional agriculture was a relatively self-contained system based largely on home produced seeds and manures and animate energy. Modern agriculture is very different in that it uses substantial amounts of commercially produced energy (mainly electricity and petroleum for running pumps, tractors, harvesters, etc.) and large quantities of industrial products (fertilisers, pesticides, agricultural machinery). In some countries this growing interaction between agriculture and industry is being reflected in an increasing involvement of industrial corporations in agricultural activities and, conversely, the establishment of industrial facilities by co-operatives or associations of agriculturists. 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.
56. The energy-industry connection is changing with a strong tendency towards a decline in the energy-intensity of industrial production in the developed countries. This is due to changes in industry-mix and improvements in efficiency. In the developing countries 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. Within the industrial sector the interconnection between different industries is increasing both through input-output linkages and through changing patterns of ownership. The blurring of industrial boundaries is particularly marked in key areas of technological advance like electronics and materials science.

57. The changes in inter-sectoral connections create patterns of economic and ecological interdependence that are generally not reflected in the institutional arrangements for policy formulation. These tend to be based on standard sectoral divisions which define the structure of public administration and business organization. The pricing of energy provides one example. Typically decisions on energy prices are determined separately for say electricity, petroleum and coal by the producing companies or by some controlling authority. The method used is generally some variant of a cost-plus pricing rule. Such an approach tends to neglect the substitution efforts engendered by price uses, the impact on using sectors, the implications for long-term energy policy and a host of other considerations. Similar arguments apply to other sectorally determined policies.
58. The sources from which environmental and ecological problems arise are seldom limited to one sector. The root causes of deforestation for instance lie in energy policy, agriculture policy, industrial policy and trade policy among other things. Sectoral organizations tend to pursue sectoral objectives and treat the impact on other sectors as "side-effects" which they will take into account only if they are 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.

The Role of the International Economy

59. Economic interactions at the national level are regulated by a vast array of policy instruments. The intention generally is to use them for sound long-term ends, though in practice short-term considerations, immediate conflicts about gains and losses and international pressures dominate. But even more than that, the very ability of governments to control the national economy is reduced by the growing interactions with the world economy and this is true both for developed and developing countries.
60. Foreign trade, particularly in primary products, shifts the locus of the environment-development connection from the national to the international level and carrying capacity and resource scarcities have to be assessed at global level. In a world where economic power is more equally distributed this shift in locus may well be beneficial and help to widen the possibilities for sustainable development for everyone. But in reality this is not the case and the gains from trade are very unequally distributed.

Growing Importance of Trade

(Exports as a Percentage of
GDP/NMP)

	<u>1950</u>	<u>1982</u>
Developed Market Economies	7.7	15.3
Developing market Economies	15.5	23.8
Socialist countries of Eastern Europe	3.4*	16.6*
Socialist Countries of Asia	2.9*	9.7*

* Percentages to net material product. (NMP)

61. The role of foreign trade in relation to national income has increased for most countries in the post-war period. Certain major changes in the pattern of world trade have also taken place. First the trade in manufactured goods increased at a rate faster than the growth in primary product trade (other than fuel) and several developing countries emerged as major exporters of manufacturers. The second major change is the rising dependence of the developed market economies on fuel imports from developing countries which accounted for 43 per cent of consumption in 1980-81 against only 16 per cent in 1959-60 and even lower than that in pre-war years. The dependence of the developed market economies

on other mineral imports from the developing countries also increased and the share of these imports in consumption increased from 19 per cent in 1959-60 to 30 per cent in 1980-81. Non-renewable resources like fuels and minerals are now far more important than tropical products and other agricultural materials in the flow of primary products from the developing to developed countries.

62. An important deviation from this general pattern is the pattern of world grain trade, which has changed greatly over the past few decades. In pre-war years, Europe was the only deficit continent and it met this deficit of about 20 million tonnes mainly from Canada and Argentina. The USSR, Asia and Africa were net exporters of cereals. At present the situation is very different. Net exports from North America have increased from barely 5 million tonnes before the war to nearly 120 million tonnes in the eighties. The grain deficit in Europe is much lower and the bulk of these exports are to USSR, Asia and Africa. Three countries, USSR, China and Japan absorbed half of this surplus and much of the rest went to relatively wealthy developing countries e.g. the oil exporters of West Asia. However the food-population imbalance in some low income developing countries led to their becoming net grain importers a phenomenon that is most obvious in Sub-Saharan Africa at present. However the volume of grain imports by the Sub-Saharan Africa accounts for less than 10 per cent of the world grain trade, which is still rooted, not in Malthusian pressures in impoverished countries but on the operation of comparative advantage.

63. The trade in primary commodities affects not merely the concerned producing sector but the entire economy of many developing countries which depend heavily on this trade for their export earnings. This dependence has declined but is still high in Latin America and Africa. In the case of the least developed countries it is exceptionally high and, what is as important, it has not declined since the mid-sixties. The production and export of primary commodities can widen options and offer additional possibilities for sustainable development. but in practice these possibilities have been reduced by the fluctuations in pricing and earnings and the fact that exporters in developing countries are dependent largely on oligopolistic trade channels based in the developed market economies which limit their ability to influence the terms of exchange and their gains from trade.

Dependence of Developing Countries on Primary Product Exports		
Percentage		
Share in total merchandise exports		
	1966	1982
Africa	86	62
America	84	52
Asia	57	22
of which		
Least developed countries	74	73

64. There are other types of ecological interdependence that operate through the trade mechanism. One element which is rising in importance, is the world trade in chemicals which was around \$140 billion in the early eighties. A large number of new chemicals enter world trade every year; some of them are banned or restricted in use in

the originating country and quite a few are inadequately tested for short-term and long-term side effects.

65. The rising importance of foreign trade has been matched by the internationalisation of investment activity in the market economies. This process of internationalization clearly increases the economic interdependence between nations and the level and pattern of investment activity in one country becomes at least partly dependent on economic policies in either countries. Investments in resource based and pollution intensive activities also heighten the ecological interdependence between nations. But even more than direct investment, the internationalization of investment has taken the form of a vast increase in bank lending and international bond issues particularly in the past decade. The debt crisis, which has had a profound effect on the environment-development situation in many developing countries is a reflection of this internationalisation of financial markets.

D. THE NEED FOR A NEW APPROACH

66. The environmental stresses that confront us today are a product of the level and pattern of world development. It is equally true that economic development is increasingly constrained by ecological factors locally and globally. The critical areas of interaction lie in the population-food-land use chain, in the causes and effects of deforestation and in the links between fossil fuel and material use and the problems of pollution. In each of these areas the central issue is not that of limits to growth but of the measures required to change the content of growth and to ensure that the benefits of development are more widely shared.

67. The root causes of environmental stress and developmental failure lie in the narrowness of objectives at enterprise, social group, national and international level. This narrowness is the result of a variety of factors - the pursuit of individual or group gains with little regard for the impact on others, rigidities in the sectoral distribution of responsibilities within public and private organizations, a blind faith in the ability of science to find solutions, ignorance about the distant consequences of today's decisions, all contribute to myopic decisions. But the problem does not lie only in narrowness of vision. Institutional inadequacies that reinforce inequalities in consumption and access to resources, that widen the gap between the area of impact of any decision and the level at which it is made and that enforce isolation where co-operation is required are also to blame.
68. Our capacity to successfully solve the developmental and environmental problems described earlier rests on a large extent on our ability to develop technologies, policies and institutions which help to reduce inequalities, increase production, conserve resources and avoid waste. As time passes man's interventions in natural processes will increase not decrease. Hence it is essential that the orientation of our efforts should be such that we take a holistic and systemic view and not be restricted in our vision by geographical or sectoral boundaries.

69. The environment-development connection must be reflected more explicitly in individual objectives and group interactions. Environmental and developmental objectives cannot be separated and the two domains of policy-making have to be combined in one framework. The objective should be to pursue a development path that can be sustained on a long-term basis without running into resource scarcities or resource degradation. But this by itself is not enough. The fruits of development must be more equally shared and so also the self-denials required to sustain development paths over the long-term. The common interest of all must prevail over sectional interests and this will require a major change in political and economic institutions. Sustainable and equitable development in this broad sense must become the basis for a new consensus on environmental and developmental policy nationally and internationally.