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Environmental responsibility in Sustainable development

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Abstract
The World Commission on Environment and Development, also known as Brut land Commission (1987), defined sustainable development as the one that "meets the needs of the present without compromising the ability of future generations to meet their own needs". Even though this definition is widely quoted, there are many conceptual and practical difficulties in evolving an operational sustainable development policy from this definition. An understanding of the nature and uses of environmental goods and linkages between economic and environmental systems would enable us to formulate a policy for sustainable development. In this paper the author made an attempt to reveal (i) the nature and uses of environmental goods, (ii) the problems in linkage between economic development and environmental quality, (iii) the problems in measuring sustainable income, (iv) to evolve a policy agenda for sustainable of Indian social cost
Key words: Environment, Sustainable Development, Social Cost

Introduction

The environment, both biological and physical, is the source of all natural resources. Some natural resources are renewable, e.g., water, fisheries, forestry, soil fertility while others are non-renewable e.g., exhaustible resources. The stock of renewable resources can decline over time if the rate of regeneration is less that the rate of harevesting. Some natural resources are private goods e.g., coal, curde oil, natural gas, minerals. Natural resources like fresh air and water in oceans are pure public goods. Forests, fisheries, lakes and groundwater are viewed as common property resources.

Environmental good satisfy a variety of human wants. Geological resources, water and air provide direct use values. They may be used as final goods or intermediate inputs. Some" natural resources like forests provide not only direct use values in the form of timber, firewood, recreation, herbs, etc. but also indirect use values such as watershed protection, carbon sink, nutrient recycling etc. They also provide option values and existence values. In short, many natural environments act as life-support systems and as parts of the major biological, geological and chemical cycles that regulate the conditions in which we all live.

Economic development and environmental quality

The laws of thermodynamics state that energy and materials that are taken out of the environment must appear somewhere else in the economic system. They must appear in the from the product, solid wastes or gases. The materials balance approach, popularized

by Kneese, Ayres and D'Arge (1970), implies that any economic activity must always affect the environment, as the environment is often used a repository for waste products. When wastes deposited in the environment exceed the assimilative capacity of the environment, degradation of environmental resources, takes place.

The linkage between economic and ecological systems is shown in Figure 1. Economic system is the originator of environmental effects. Uses of materials and energy in production process generate wastes. In the absence of binding environmental regulations, polluters discharge the wastes into the environment i.e., the environment is reated as if it is a free good. Environmental degradation occurs when the quantity and quality of wastes discharged into the environment undergo many transformation due to meteorological and other factors. Our knowledge about the nature and speed of the transformations is very limited, because the effects are distributed over time in a stochastic manner. Environmental degradation affects the quantity of natural and physical resources.

Figure 1 Linkage Between Economic and Ecological System

Technology materials energy	Emission of pollutants into air, water and land	Dispersion and transformation in the environment
Economic system production consumption	Cost - Aversive - Abatement	Environmental damages human health animal and plants assetscosystem

Our knowledge about the links between levels of pollution and damages to human health, animals, crops, physical assets and ecosystem is still meager. However, we observe society incurring costs in the forms of defensive expenditure and losses in future outputs, amenities, scenic beauty, and biodiversity.

Does it mean that any economics development necessarily imply environment degradation? During the mid-seventies and early fifties, many scientists voiced concern about this possibility. Meadows and others work on limits to Growth (1972) cautioned about exhaustibility of certain valuable mineral and energy resources within a few decades. Some environmentalists expressed the view that natural resource constraints would limit the carrying capacity of the natural environments to act as sinks for waste products and hence a positive rate of growth of income cannot be expected to continue for ever.

The Burt land commission definition of sustainable development raises questions regarding the meaning "needs" and the concept of inter-generation equity. According to Solow (1991) sustainability is about distributional equity. "It is about the sharing of well being between present people and future people". Pearch and Warford (1993) prefer to substitute the word welfare for needs and restate the definition of sustainable developemtn as the one that "Secures increases in the welfare of the current generation provided that" welfare in the future does not decrease", (p.49). This definition is consistent with the Pareto criterion of improvement in welfare. If welfare improvement is measure not in the narrow sense of an increase in real per capital income but in the sense of a

general increase in the quality of life, then this definition would be acceptable to most economists and other concerned with economic policies.

Both definition of sustainable development incorporate some notion of intergenerational equity. But changes in welfare between two generations depend not only on the quantities and qualities of environmental capital between the two periods but also on the quantities of man-made capital, stock of human capital, and technical advances between the two periods. Following Pearce and War ford, we may write the total capital stock in period to as $K(t) = Km(t) + (t) + Kn(t)$

Where m denotes man-made capital, h denotes human capital and ndenotes natural capital (soil fertility, forests, fisheries, mineral resources, ozone layer, capacity to assimilate waste etc. One could define sustainable income as the maximum income that can be generated without decreasing the total stock of capital. In this formulation, it is the quantity of total capital stock that determines the aggregate real income in any period.

Can faster rates of growth of man made and human capital stock compensate a decrease in the quantity of natural capital stock? (Km+Kn) and Kn are perfectly substitute, then Kn need not be a constraint on growth. Both common sense and empirical evidence suggest that the scope for substitution between (Km+Kn) and at least a subset of Kn is limited. This possibility arises when some environmental damages are irreversible. We observe many instances where the wastes discharged into the environment exceed the assimilative capacity of the environment. When industrial effluents with high-concentration of pollutants are discharged into water bodies or on land for a long period of time, the water bodies including groundwater become unsuitable for biotic life. Emissions of sulfur dixides, nitrous oxides and nitric oxides in the atmosphere increase the probability of getting acid rain. Large scale emissions of greenhouse gases e.g., carbon dioxide, methane and CFC's increase the probability of global warming within our life time. These evidences show that rapid economic growth with lack of concern for conservation and clean technologies can constrain the growth prospects. Some natural resources may provide high existence values and hence their stocks cannot be allowed to depreciate or degenerate.

In a developing economy with very per capita income, high rates of unemployment and under employment and about two-fifth of population living below the povery line, intra generational equity assumes special significance in the formulation of economic polices. Historical experiences of developed countries show that, in general, current generation are better off than earlier generations because the former have access to modern technology and opportunity for greater choices in many decision problems. There is some asymmetry in intergenerational equity comparisons because the present generation can make the future generation better of by a variety of policies such as conversion of exhaustible resources, higher savings and capital formation, R&D investments etc.,but it is not feasible for the future generation to compensate the present generation. Concern of future generation in

the sense of slowing down the rate of depletion of exhaustible resources or investment in environmental protection necessitates a low social discount rate, but concern for poverty reduction in the present generation requires a high social discount rate. Solow (1991) notes that "there is something faintly phony about deep concern for the future combined with callousness about the states of the world today. The catch is that today's poor want consumption not investment. So that conflict is pretty deep and there is unlikely to be any easy way to resolve it". Even Rawls l971) Theory of justice provides no guidelines for analyzing inter-generational equity problems.

Measurements of total capital stock and sustainable income put severe demands on information gathering and processing capabilities. As a first step, we need physical material balancing accounting for each natural resource. We must start with quantity of stock in a base period, measure addition to the stock in every period in order to arrive at a net measure of physical stock at the beginning of next period. It is possible to construct such physical accounts for major energy resources and mineral deposits, and water. For common property resources, such as forests, fisheries, we don't have the requisite information, if ? areas such as biodiversity, we do not have even a documentation of all types of species. Hence, the first important step is to create the capacity for constructing a physical accounting. With the support of UNDP and the Ministry Environment& Forests, the Indira Gandhi Institute of Development Research has started an exercise on the construction of natural resource accounting for India (Parikh and others (1993). See Bartelmus, Lutz and Tongern (1994) for environmental accounting from an operational perspective.

The second important step is valuation of the resources. Most of the environmental resources are not marketed. Markets don't exist because of the difficulties in defining property rights for some of the resources and high transaction costs involved in establishing and operating the markets. However, economists have made attempts to measure the value of environmental quality or damages due to pollution using a variety of techniques such as the averting behavior approach, hedonic cost function approach, dosage function approach and contingent valuation approach (see Cropper and Oates (1992) for. a survey and references to the literature).

With the use of natural resource accounting and the valuation techniques, it would be possible to estimate the value of each natural capital stock, depreciation value for each of the stocks and then arrive at a measure of net stock each of the stocks. This accounting would also facilitate the estimation of sustainable income.

Policies of Sustainable Development in India

A review of the evaluation of environmental policies in developed countries shows that historically governments have tended to rely on direct regulation or command and control (CAC) type of regulation (See Opshoor and Vos, 1989). This type of regulation imposes physical restriction on emissions/effluent, processes, input usages. Each physical

restriction has a shadow price which in un observable to the regulator. CAC regulation in highly information intensive and often results in principal-agent problems. It is also not cost effective.

The Constitutional Amendment Act, 1976 (Section 48A and 51A(9) and Article 21 as interpreted by the supreme court and High courts, vest the property rights for environmental natural resources. Legislations have been enacted to prevent and control water and air pollution. We have a comprehensive environmental protection Act and many laws and rules relating to use of hazardous wastes and public liability insurance. We have created institutional structures e.g. Central and State pollution Control Boards, Ministry of Environment and Forests and many other administrative agencies for implementing the laws and rules. A critical review of the environmental policy regime in India reveals that it relies heavily on CAC type policies. See Sankar (1998)

In recent years, many countries rely more on economic instruments for prevention and control of pollution. The Rio Conference (1972) specified the following objectives of environmental policy.

a) To incorporate environmental costs in the decisions of producers and consumers, to reverse the tendency to treat the environment as "free good" and to pass these costs on to other parts of society, other countries or to future generations,
b) To move more fully towards integration of social and environmental costs into economic activities, so that prices will appropriately reflect the relative scarcity and total value of resources and contribute towards the prevention of environmental degradation,
c) To include, wherever appropriate, the use of market principles in the framing of economic instruments and policies to pursue sustainable development (Agenda 21, Chapter 8, P. 85)
d) In India also, the Policy Statement for Abatement of Pollution, issued in February 1992m recommends a mix of CAC and market based instruments (MBI) for environmental protection.

Economic instruments may be classified as direct and indirect instruments. Pigouvian tax on pollutant equal to its marginal social damage is a direct economic instrument. Creation of market for pollution rights (Dales (1968) is also economic instrument. Other examples of direct economic instruments are performance bonds, strict liability scheme for polluters and deposit refund schemes for used products. These direct economic instruments signal the polluters about the social costs of pollution and thereby enable them to internalize the external costs in their private decision.

Design and implementation of direct economic instruments also involve costs to society. For the application of the pigouvian tax, the regulator needs information regarding marginal abatement cost and marginal benefit from pollution reduction a the social

optimum. Information about the damage function is rarely available to the regulator. This is the reason why Baumol and Oates (1998) advocate a second best pollution control policy. This policy problem is one of minimizing abate net costs fo reaching minimum national standard (MINAS.) Even in the case of a single pollutant estimates of marginal abatement costs are sensitive to factors such as the volume of influent, concentration of pollutant in the influent, product mix, process used, plant vintage etc (see Metha, MUndle and Snkar (1993). Creation and operation of markets for pollution rights also involve lot of preparatory work, and administrative and enforcement costs. See Cropper and Oates (1992). Because of these difficulties many countries prefer indirect instruments such as taxes on output, taxes on inputs and use charges which are easier to implement.

CAC regulation is preferred when production or use of a good can result in a heavy damage to society. This is reason why almost all countries impose physical restrictions, including bans, on the use of haszardous materials. The characteristics of environmental goods (or pollution) have also an important bearing on the decision whether to find a solution through the state, or market, or a special institution or cooperation among institutions.

When pollution is of the "Public bad" or transborder type e.g. global warming, depletion of zone layer, loss of biodiversity, we need international agreements on pollution control and cost sharing mechanisms. International agreements and cost sharing schemes have already been devised for dealing with issues such as depletion of ozonelayer, climate change and bio-diversity. Proposals are under consideration for creation of markets for tradeable permits for carbon dioxide and sulphur dioxide emissions at the international level. The major problems to be solved are (a) the basis for allocation of the permits among countries and (b) creation of effective institutional machinery for enforcement. See Pearce and Warford (1993) and Srinivasan (1995). The developed countries have agreed to reimburse part of the costs incurred by the developing countries have agreed to reimburse part of the costs incurred by the developing countries on reduction of green house gases on the basis of the incremental cost principle. Thus there is a need for undertaking combinatorial type of cost studies for availing the financial support (See Sankar (1995).

When pollution is a local bad, e.g. water pollution in lakes and water streams, solid waste generation, considerations such as information requirements as well as monitoring, dictate that the design and implementation of pollution prevention and control policies be left to state governments or/and local bodies. NGOs canbe associated with such projects from the project design stage to the implementation stage.

When the environmental problem relates to common properties, e.g. a forestation and fishing, at present, greater reliance is being placed on technical and administrative aspects and very often the prescription is imposed from outside. We need a cooperative institutional mechanism to promote the stake holders participation in project formulation,

rule making, cost sharing and enforcement. The cooperative solution should be based on Rawlsian principles of fairness, efficiency (in Paretian sense) and stability.

Most environmental problems resulting from production and use of private goods can be tackled by relying mainly on MBIs. First, we must correct the existing distortions in the markets for gasoline, diesel, power, water, irrigation, fertilizers and pesticides. Most of these scare resources are under priced, eventhough their production or / and use often result in environmental damages to society. The subsidies, implicit and explicit, must be contained and prices must, atleast on the average, cover the average costs, Second, we must fix time schedules to implement prices which reflect the social costs of these products. See for example, Sankar and Mathur (1998).

In the Indian context, these price reforms will not only eliminate the financial losses of most of the public enterprises but also encourage conservation of these scarce resources. Even though there is ample scope for conservation of energy, water and other scarce resources, we have not yet achieved the goal because of wrong price signals, lack of information about the benefits of conservation, and other institutional impediments. Conservation of energy and water can also reduce the environmental intensity of many products and services and thereby promote sustainable development.

The above discussion shows that a choice among the instruments should be based on considerations such as information intensity, economy efficiency, ease of implementation and political acceptability.

Greater reliance on MBIs does not necessarily mean reduced role for the government in environmental protection. As Coarse (1991) has argued that, even in a discrete choice situation of either government or market, the choice has to be made on which of the institutions can achieve the goals at the least cost, we envisage an important role for the government in evolving a legal framework, determination of minimum national standards, development of clean and abetment technologies, regulation of hazardous wastes, creation of and access to information system on environmental matters, creation of markets for trade able permits wherever feasible, provision of institutional and financial support for common effluent treatment plants for small scale units in industrial areas, articulation of India's environmental concerns in global forums, creation of environmental awareness etc. In short, the government must create an enabling environment for markets and other institutions to achieve the goal of sustainable development at least social cost.

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