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Economy and Environment: Some Vital Links*

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ABSTRACT

In the evolution of economic thought on economic growth we have reached the third stage, when the concern is with sustainable development. This paper explores ways to minimize environmental deterioration in such a way that the capacities of the future generations to live as well as we are can remain unimpaired. Following Solow's approach to sustainability where when we use up something that is irreplaceable, we should be thinking about providing a substitute of equal value. The something we provide could be knowledge or technology.The paper discusses the following issues- technology as a double edged sword, the benefits and challenges of using National Resource Accounting, the intra-generational issues in achieving sustainability and the superiority of market based instruments over command and control instruments in controlling pollution.

Keywords: sustainable development; carrying capacity; national resource accounting; intra-generational; climate change; market measures

Clean air, clean water and clean atmosphere can no longer be taken for granted. The environmental degradation has reached a point where its impact is felt even today, let alone tomorrow. We are today living not only in a "plundered planet" as Kenneth Boulding put it, but also a "polluted world." Economic growth and environmental preservation are not any more opposing objectives. Environment-friendly economic growth has emerged as a necessity.

Initially men and women lived in the awe of nature. They were in fact, terrified by the forces of nature. Nevertheless they loved nature. Mountains, forests and rivers have always fascinated human beings. The literature in all languages bears testimony to this. Human societies have been altering the face of earth since they began. Use of natural resources for the benefit of the human beings did not cause much concern so long as the utilisation was within the rejuvenating capacity of nature. What is new and disturbing is the pace and scale of utilisation that started about 50 years ago. Population and economies are growing exponentially but the natural resources that support them do not. The days of the frontier economy when abundant resources were available to propel economic growth and raise living standards are over. We have entered an era in which prosperity increasingly depends on using natural resources more efficiently.

SUSTAINABLE DEVELOPMENT

One can see three distinct stages in the evolution of thought on economic growth. In the first stage, the major concern was simply to accelerate economic growth and economic growth was identified with

* An updated version of the WWF India Conservation Day lectures 1998.

increased availability of material goods. The need for accelerating growth was felt even more strongly in developing economies which started out with very low living standards. Poverty eradication meant faster economic growth. In the second stage, economists started making a distinction between growth and development. Development was seen as going beyond economic growth and bringing about certain changes in the structure of the economy. Increasing emphasis was laid on the more equitable distribution of the benefits of growth and also creating conditions in which growth will become automatic. We have now reached the third stage, when the concern is with sustainable development meaning thereby not only development of the present but also of the future. Thus the focus has moved, as was aptly put, from "sustained growth" to "sustainable development."

"Sustainable development" is a term that appears often in the literature on environmental economics. This concept brings to the fore the long-term relationship between ecology and economic development. The definition of "sustainable development" that has gained wide acceptance has been the one given by the Brundtland Commission which says "sustainable development is development that meets the needs of the present without compromising the ability of the future generations to meet their needs (Brundtland,1987)." This description of sustainable development contains an important idea, even if it lacks operational precision. The underlying thought here relates to intergenerational responsibilities. Broadly seen, this definition would imply that it is the responsibility of each generation to pass on to the next what it has inherited as a stock of natural resources without any deterioration. While recognising the obligation of each generation to the following generations, some thinkers have taken objection to the injunction such as the one pointed out by UNESCO that "every generation should leave water, air and soil resources as pure and unpolluted as when it came on earth." The argument is that such an injunction is infeasible, as it would imply, for example, not to make use of any mineral resources. The future is unknown; what the needs of the future generations will be and what technologies will be available to them are all unknown. Nevertheless, there is an obligation to conduct ourselves in such a way that future generations have the capacity to be as well off as we are. This does not however, mean that we cannot make use of any of the natural resources to meet the needs of today. There is of course a fundamental difference between renewable natural resources and non-renewable resources. However, this distinction also becomes weak when renewable resources are polluted to such an extent that what is left behind is so inferior in quality that it is almost comparable to the depletion of non-renewable resources. Given the fact that natural resources will have to be utilised, Prof. Solow come up with an alternative approach to sustainability which is worth quoting. He says "A correct principle, a correct general guide is that when we use up something—and by we I mean our society, our country, our civilisation, however broadly you want to think—when we use up something that is irreplaceable, whether it is minerals or a fish species, or an environmental amenity, then we should be thinking about providing a substitute of equal value, and the vagueness comes in the notion of value. The something that we provide in exchange could be knowledge, could be technology. It need not even be a physical object" (Solow,1991). Viewed this way, environmental protection can be achieved through investment. What this approach seems to emphasise is that resources are fungible and therefore, what has been destroyed can be substituted by some other resource, tangible or intangible. Solow writes "In making policy decisions we can take advantage of the principle of substitutability, remembering that what we are obligated to leave behind is a generalised capacity to create well-being, not any particular thing or any particular natural resource" (Solow, 1991). This approach to sustainable development assumes that all natural resources are substitutable and the degree of substitution is high. Perhaps this is taking the argument too far. Sustenance of human life on earth will require the availability of certain natural resources and the degree of substitution could be zero in such cases.

If the resilience of the eco-system and other natural balances are disturbed, a fundamental damage can be caused. The obligation to preserve the natural resources cannot, therefore, be wished away. The

question is not one of preventing or eliminating environmental deterioration totally as much as how to minimise it in such a way that the capacity of the future generations to live as well as we are can remain unimpaired.

GROWTH AND SUSTAINABLE DEVELOPMENT

Given the pressing need for meeting the current demands, a question that is often raised is whether or not developing countries should pursue growth first and then take care of environmental problems. As Prof. Chakravarthy once mentioned, this concept is not maintainable because in most situations it is not possible to revert to the old state of affairs once certain things have been destroyed almost irreversibly. Economists call this phenomenon as "path-dependant equilibrium." In a dynamic system which is non-linear, it is not possible to reach the same equilibrium (David, 2001). It becomes, therefore, necessary that ecological concerns and growth concerns are addressed simultaneously.

Closely related to "sustainable development" is the concept of "carrying capacity." Biologists define carrying capacity as the largest number of any given species that a habitat can support indefinitely. When that maximum sustainable level is achieved, the resource base begins to decline and as this happens population also begins to decline (Small et al., 1998). It is true that human interactions with the environment are far more complicated than those of other animal species. Man's ability to bend nature is far greater than that of any other species. However, global problems of ozone depletion and green house warming have clearly shown that human kind is not exempt from the general law. Nature's ability to absorb our waste products and to provide the sustainable supply of essential resources is getting eroded. In this context, Sandra Postel has drawn our attention to an analogy from the maritime world. Ship captains, we are told, pay attention to a marking on the vessels called the Plimsoll line. If the water level rises above the Plimsoll line, the boat is too heavy and it is in danger of sinking. When that happens rearranging the items on the ship will not do. The problem is the total weight, which has exceeded the carrying capacity of the ship. The ecological equivalent of the Plimsoll line may be defined as the maximum share of the earth's biological resources that humans can appropriate before a steep deterioration in the planet life support system is set in motion. The question that we have to pose ourselves is how close are we to this critical mark.

TECHNOLOGY AND ECOLOGY

No doubt technology has helped us to harness the forces of nature thereby enhancing our capacity to raise living standards. It has helped us to put to rest the Malthusian devil. Our past achievements in raising resources efficiency and productivity should not delude us into thinking that any constraint can be overcome. Technology has proved to be a double-edged sword in many cases. For example, it is now known that the chlorofluorocarbons, which are found to be ideal chemicals for so many different uses, once they reach the upper atmosphere begin destroying the ozone layer. During the last three decades the agriculture sector world over has registered substantial improvement in productivity. This was the result of a package of technology comprising of high yielding variety of seeds, assured supply of water and intensive use of chemical fertilisers and pesticides. India is one of the major beneficiaries of these technologies which ushered in the "green revolution."' However it is becoming increasingly clear that a very high level of the use of inputs such as chemical fertilizers can lead to land degradation and other ecological and environmental problems. Can bio-technology be the answer to the problem? Thus it turns out that technology is part of the problem and it is also part of the solution. We need to discriminate between the technologies that meet our needs in a sustainable way and those that harm the earth. Nature has never been left alone by man. The past was not certainly one long era of green

wisdom. Some of the practices of the older societies such as shift cultivation have also resulted in the destruction of forests and other natural resources. However, the scale of operation was small. Technology has placed in the hands of mankind enormous powers of both creation and destruction. That is why we have to agonize about technology. The eminent British scientist Julian Huxley wrote "It is as if man had been suddenly appointed managing director of the biggest business of all, the business of evolution … Whether he wants it or not, he is determining the future direction of evolution of this earth" (Huxley, 1968). We need to develop a new sense of environmental responsibility in which nature, humanity and technology will work together.

NATIONAL RESOURCES ACCOUNTING

Even though environmental degradation is there for everyone to see, our valuation of products and services and the measurement of national income do not reflect this deterioration. This perhaps was of no consequence at a time when natural resources were plenty and could be regarded as free goods. This obviously is no longer true. There are costs to air and water pollution, soil erosion, deforestation and degradation of other natural resources. The problem here is of course our inability to assign correctly the value or the price to such degradation. It is basically the present value of the growth foregone in the future as a consequence of the degradation. Clearly there are no simple or easy ways of estimating such costs even though damage control costs can be measured from the financial outlays they require. Nevertheless an attempt, however imperfect it may be, has to be made to attribute costs to environmental degradation and this can force the present generation to be more careful and cautious in using the natural resources. It is precisely in this context people have been talking about natural resources accounting. The basic principle underlying national resources accounting is that national income statistics must incorporate not only changes in the stock of manufactured capital but also natural resources. Various national accounting measures such as Net National Product and National Income now incorporate only deterioration in the manufactured capital stock. It has, therefore, been suggested that every country should also prepare a separate net nature product which is a measure of net changes in the environmental resource base. The true measure of the net national product of a country should be the sum of the conventional net national product and net nature product (Agarwal, 2005). For example, environmentally-adjusted net domestic product of Mexico in 1985 was lower (39.7 billion pesos) than the conventional national income accounts (42.1 billion pesos) (Hamilton and Lutz, 1996). When adjusted to reflect depletion of natural assets, the net capital accumulation showed a decline from 11 per cent to 6 per cent of the net domestic product. It must be admitted that attempts to create national resource accounting systems run into the formidable problem of valuing natural resources, even though it is possible to do the accounting in purely physical units as is being done in Norway in which case it is not possible to combine it with the conventional net national product. In valuing natural resources there are many conceptual difficulties apart from paucity of data. Despite these problems, natural resource accounting is recommended in order to keep everyone reminded of the environmental consequences of economic activities. Considerable work has been done in analysing measurement problems associated with natural resources. Valuation of natural resources has to be related to the type of resource depending on whether it is a stock or a flow and whether it is exhaustible or renewable.

Accounting is not the end. Accounting must lead to accountability. Projects which make large use of natural resources must be made to be conscious of environmental degradation by compelling them to undertake an environmental impact study. Though the ideal method of evaluating a project is to incorporate environmental costs into the financial cost-benefit analysis, at least as a first step almost all large projects must be required to have separate environmental impact assessment.

INTRAGENERATIONAL ISSUE

"Sustainable Development" is most often discussed as an intergenerational issue. It is equally an intra-generational issue between the developed and the developing countries, between those who were enjoying already high standards of living and those with low standards of living. It is estimated that 18 per cent of the world's population is living a life style that uses 80 per cent of the resources (UNDP, 1989). The burden of environmental protection not only today but also in the future must be borne by countries which have exploited the natural resources to the maximum now. The responsibility is greater on their shoulders for containing pollution of various types. The poorer nations of today have greater demand on the natural resources of the future than the currently rich countries. This is not a kind of international arrangement which can easily be worked out. It needs, however, to be done. This is an inevitable concomitant of "sustainability."

ENVIRONMENTAL PROTECTION

The concern for environmental protection has been heightened in recent years because of the impact environmental degradation is already having on the people today. The quality of life is getting diluted even as production of material goods is increasing. The Rio Declaration on Environment and Development reaffirms the need for sustainable development and calls for cooperation in a spirit of global partnership to conserve, protect and restore the health and integrity of the earth's eco-system. The evolution of laws, institutions and policies relating to environmental protection in India has been the subject matter of many studies. The initial legislations in this regard date back to the pre-independence period. The Bhopal gas tragedy in 1984 triggered a comprehensive legislation in the form of the Environment (Protection) Act 1986 and also Public Liability Insurance Act in 1991. The Policy Statement for Abatement of Pollution issued in 1992 contains objectives similar to the ones set forth by the UN Conference on Environmental Development held at Rio.

1. to incorporate environmental costs in the decisions of producers and consumers, to reverse the tendency to treat environment as a "free good" and to pass these costs on to other parts of society, other countries or to future generations;
2. to move more fully towards the 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; and
3. to include, wherever appropriate, the use of market principles in the framing of economic instruments and policies to pursue sustainable development.

The Policy Statement for Abatement of Pollution favours a combination of regulatory and market instruments to prevent and control pollution in India.

COMMAND AND CONTROL AND MARKET MEASURES

Broadly speaking, there are two sets of policies which can be used for controlling pollution. They are command and control measures and market-based instruments. In India so far, there has been an overwhelming reliance on command and control measures which have taken the form of emission regulation which are source specific and regulation of equipment and processes. Market-based incentives work through effluent charges, tradeable permits and input/output taxes to modify behaviour. Historically all countries started out with command and control measures for the purposes of control of pollution. Command and control measures apply uniformly to all polluters such that the same environmental quality has to be achieved by polluters irrespective of their abatement cost structure.

With any uniform emission or effluent standard, there is no incentive to abate beyond the required level. As a consequence, many countries are now moving towards economic instruments incorporating the approach that the polluter should in principle bear the cost of the pollution. Market-based instruments can be classified under two categories: (a) direct economic instruments such as pollution charges/taxes, user charges, tradeable permit scheme, deposit refund scheme on used materials and strict liability for potential damages; (b) indirect economic instruments such as taxes/charges on products whose production result in pollution; taxes/charges on inputs used in production of goods which generate pollution; taxes (subsidies) on goods which are complements (substitutes) to goods whose production result in pollution; and fiscal incentives for encouraging clean technologies, abatement technologies and conservation of fuel, minerals and water (Chakraborty et al.,1996).

Among the direct economic instruments the most commonly used are pollution charges/ taxes and user charges. Pollution charges/taxes are often referred to as Pigouvin taxes named after the economist A.C. Pigou who first proposed them in 1920. These are charges levied on polluters based on the quantity and/or quality of pollutants discharged into the environment. This charge or tax should be equal to the marginal cost of pollution abatement, given a specified standard for the pollutant. This type of charge gives an incentive to the polluting firm to reduce the pollution up to the point at which its marginal abatement cost equals the charge rate. User charges are direct payments for the costs of collective treatment of pollution such as the collection and treatment of municipal solid waste. User charges have become common with respect to the disposal of wastewater and solid waste. Many countries have introduced charges which vary with type of waste. Incentives are also being given for the polluters to separate the waste into biodegradable waste, non-biodegradable waste, toxic materials etc. The U.S. has also experimented with what is known as marketable permits. Under this approach the pollution control agency determines a target level of environmental quality and translates this into a total number of pollution permits. These permits are allocated among the existing enterprises on the historical pattern of emission or the permits may be auctioned. These permits are tradeable and the price of a permit is determined in the market for the pollutant. Polluters with abatement costs below the permit price have an incentive to undertake abatement. The emission reduction by firms with low abatement costs are certified by the environmental authority and these firms receive emission reduction certificates. These certificates can be sold to other polluting firms whose abatement costs are higher than the permit prices. Since the overall ceiling of allowable discharges are fixed a priori, the permit system unlike pollution charges ensures a given level of environmental quality. Setting up standards, issuing permits and specifying conditions for the transferability of the permits require efficient and imaginative regulatory agency. The scheme has been found to be successful in the case of uniformly dispersed pollutants and where there are large firms among whom trading is possible.

Among the indirect instruments the most commonly used are product tax or input tax. Fees are added to the price of inputs or products that are potentially polluting in either the manufacturing or consumption phase. An example of input taxes is a tax on carbon or sulphur content of coal. These taxes/charges increase the price of these commodities, thereby discouraging their use. These charges are considered "second best" since they are not levied directly on the polluting activity but on proxies to it.

The need for moving away from purely command and control measures to market-based instruments is recognised in India as well. Command and control measures are still suitable for products that are hazardous and toxic. However, our experience shows that the administration of such controls has not been that effective. Apart from moving towards market-based instruments which incorporate polluter-pays-principle, we need to strengthen the administrative machinery available to the various regulatory agencies considerably.

Environmental protection goes very much beyond pollution control which at best helps to prevent further deterioration of the environment. We need positive steps to extend the forest cover,

rejuvenate degraded lands and improve ground water resources. In fact, ground water depletion is a very serious problem in several parts of India. Improvement of degraded lands is an area in which ecological improvement and economic growth go hand in hand. Better harvesting of water through well-designed watershed management programmes can bring about significant changes in the life of the rural people in many areas. One major issue in this context has been the development of effective institutions legally empowered to manage common natural resources. Our experience with respect to watershed management as well as afforestation programmes clearly shows that community or group ownership of natural resources are not only feasible but is essential. It has become clear that forest management, for example, is almost impossible without the active participation and support of the people.

In poor communities environmental concerns do not weigh heavily on the minds of people. The demands of today are seen more pressing than the claims of tomorrow. However, with the kind of ecological degradation one has seen even in such countries, "growth first, ecology later" is not a feasible proposition. In our own country, the water and air pollution in most of our big cities has crossed the tolerance limits. Many rivers and lakes are highly polluted with toxic wastes being dumped into them. Deforestation on a large scale has led to soil erosion and to the silting of dams and canals. We need a multi-pronged approach to tackle environmental concerns.

1. Pollution control must take top priority to prevent further deterioration. Pollution controls must be tightened with greater emphasis on pollution charges and taxes on inputs and outputs. Effective organisational mechanisms to achieve results must be created.
2. Policies which result in profligate use of resources such as water must be reviewed and user charges, wherever possible, must be levied.;
3. Special action plans to take care of highly polluted water ways or highly denuded mountain ranges may have to be drawn up; and
4. Ggreening of degraded lands with community participation and involvement must be initiated so that those who are involved in the action can reap the benefits.

CLIMATE CHANGE

An aspect of ecological degradation is climate change. Climate change is defined as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. The major characteristics of climate change include a rise in average temperature, ice cap melting, changes in precipitation, and increase in ocean temperature leading to sea level rise. The cause of climate change is an excessive emission of gases such as CO2 and methane. Scientists are at work trying to measure the impact of greenhouse gases in terms of likely increase in temperature and changes in precipitation. It has however to be noted that various studies give different results. For example the Parallel Climate Model (PCM), a Washington-based think tank predicts an increase in temperature by 2.5°C in 2100 whereas the Canadian Climate Centre General Circulation Model predicts an increase of 4.0°C (Mendelsohn et al., 2006). Similar differences are also noted with respect to precipitation. While there is a need to come to a consensus on the likely impact, there is no doubt about the direction in which changes will occur. Research studies indicate that climate-sensitive sectors have a hill-shaped relationship with absolute temperature. For each sector there is an optimum temperature that maximizes welfare or output in that sector. For farmers in regions that are cooler than the optimum temperature, warming could cause net revenues to go up. For farmers in regions that are warmer than the optimum temperature, warming would cause net revenues to fall. These results imply that countries that happen to be in relatively cool regions of the world are likely to benefit from warming and countries that happen to

be in relatively warm regions of the world are likely to be harmed by warming. Countries like India fall in the latter category. Agriculture on which even now more than 50% of the people depend is a highly climate sensitive sector. Climate change does not also uniformly affect all regions within a vast country like India. It is thus imperative to look more closely as to how climate change will affect different parts of rural India. Of course this understanding must lead us to see what actions can be taken to mitigate the impact. Adaptation is thus critical. But the fundamental issue is how to reduce greenhouse emission and limit climate change. This is a task which must be addressed by all countries. Unfortunately even the limited Paris Agreement is in danger of being disregarded. India is the world's third largest emitter of CO2. However in per capita terms India's CO2 emissions are low. It is 0.5 tons as compared to 4.4 tons in the USA, and 13.5 tons in Qatar. The various studies pointing to the dangerous consequences arising from climate change must bring about a change in altitude, particularly in countries like the USA which are recalcitrant.

CONCLUSION

The awareness of the close links that exist between nature and human life must spread. It is ironical that when a man kills a tiger, it is described as a sport and when a tiger kills a man, it is called cruelty. Each specie of life has its own place in the environment. We need to recognise this fully. Man's ability to bend nature has its limitations. There cannot be infinite growth in a finite environment. May be the life style of people itself must undergo a change. Someone has gone to the extent of saying that the "efficiency revolution" must be accompanied by a "sufficiency revolution." The key to achieve sustainability may not be so much as to produce less as to produce differently. New patterns of consumption and new technologies involving cleaner production processes are the need of the day. Improved quality of life at a lower intensity of resource use is what we must seek and achieve.

REFERENCES

Chakraborty, D., & Mukhopadhyay, K. (2014). *Water Pollution and Abatement Policy in India.* Springer Publication.

David, P.A. (2001). Path Dependence, its Critics and the Quest for 'Historical Economics'. *In Evolution and Path Dependence in Economic Ideas: Past and Present* (pp.15, 40). Edward Elgar Publishing.

Brundtland G.H. (1987). *Our Common Future: Report of the World Commission on Environment and Development.* Oxford University.

Huxley, J. (1968). Transhumanism. *Journal of Humanistic Psychology*, 8(1), 73–76.

Hamilton, K., & Lutz, E. (1996). *Green National Accounts: Policy Uses and Empirical Experience.* Paper No.39, Environmental Department, World Bank.

Mendelsohn, R., Dinar, A. & Williams, L. (2006). The Distributional Impact of Climate Change on Rich and Poor Countries. *Environment and Development Economics*, 11(2), 159–178.

Agarwal S.K., (2005). *Environmental Management*. A P H Publishing.

Smaal, A. C., Prins, T.C., Dankers, N.M.J.A., & B. Ball, (1998). Minimum Requirements for Modelling Bivalve Carrying Capacity. *Aquatic Ecology*, 31(4), 423–428.

Solow, R. (1991). Sustainability: An Economist's Perspective [The Eighteenth J. Seward Johnson Lecture in Marine Policy]. Marine Policy Center, Woods Hole Oceanographic Institution.

UNDP (1989)., Human Development Report.

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