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Application of Economics in Environmentally Sustainable Development : Reference to Asia and the Pacific Region

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INTRODUCTION

The need for careful economic decision making in sustainable management of environment arisen not due to the scarcity of the natural resources alone, but mainly due to the economic loss associated with the environmental degradation as a by-product of the economic activities. However, it is recently being recognized that the sustainable long term development and environmental management are not conflicting but complementary concepts. Efficient use of the economic tools such as benefit-cost analysis and environmental national accounting etc. can effectively bring the non-marketed environmental factors into the market pricing system with their greater implications for economic policy decisions. Although it is widely recognized that the private sector has greater role to play in the national development, environment is one area in which maintenance of the central role of the government should still be greatly appreciated.

Natural environment is an economic asset as it provides goods and services with economic values. The natural capital is converted into economic properties through a series of economic transformation processes. The intensity and composition of these services depend on human actions and are limited by the stock of environmental assets.

Basic problem lies in the sense that the economic system extracts inputs from the natural environment and converts them into output, (goods and services) to serve the human beings. The by-products and the waste generated from the consumption of these goods and services are deposited into nature again. But the natural sector has a time bound process to convert back the waste into ecologically useful products. When natural absorptive capacity is not given sufficient time to transform the waste into the productive input again, the process becomes problematic. This is where the economics of environmental management becomes a serious concern for the policy makers.

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Economics is about the rational use of the scarce resources, but the main focus hear is, not the danger of running out of marketed non-renewable energy and raw materials, but the unmarketed side effects associated with their extraction and consumption. For example, the environmental effect of fossil fuel use (local air pollution and carbon dioxide emissions) is more serious than the potential shortage of the fuel. Also, the problem of mineral extraction is reflected in the pollution and destruction of natural flora and fauna, because almost 95 percent of mineral extraction from earth contain heavy metals such as iron, tin, copper, which normally go into soil, ground-water and river etc. The Table 1 illustrates the fact about the abundance of the natural resources :

Table 1

Energy and Mineral Resources and Consumption

Particulars	Index of Commercial Reserve (1970=100)	Annual Consumption as Percent of Reserve	
	1988	1970	1988
Crude Oil	163	2.7	2.2
Gas	265	2.1	1.5
Copper	131	2.6	3.1
Tin	150	5.4	3.7
Zinc	176	0.3	0.2

Source : *World Development Report 1992, P. 37, WB.*

As seen in the Table 1, efficiency gains achieved due to technological change and substitution has ultimately reduced growth in demand for these products. Also, current consumption, as proportion of reserves, has declined for several mineral and energy resources.

The main objective of the paper is to make aware the educators and administrators about the role of economic decision making for environmental management. The target audience is mainly the people with some basic secondary level of education. Motivated basic level workers from NGOs also may form the group of audience. The trainers may be the graduate school teachers in economics with some village level experience. The scope of this package is vary broad encompassing even those category of people normally termed as *the newspaper readers* or literate people with interest in the village social work.

The facts and arguments put forward in the paper may be reproduced/reinterpreted in simple local languages without missing the basic message about the role of economics in sustainable management of the environment.

The intended medium of communication to deliver the message in the paper are the class rooms, seminars and informal discussion forums

at the local level. The trainers are free to refer relevant photographs, posters etc. to communicate more effectively with the audience. There is no specific need for the field visit during he course of training, particularly for this paper. However, examples of environmental degradation in a particular place, successful environmental protection measures taken etc. can be cited where relevant.

The paper is principally designed with the date and information drawn from the experience gained by the author in the area of socio-economic research in Nepal and other developing countries and from the sources cited in the reference. The paper is divided into mini sections starting from introduction of the discussion about the significance of the study, followed by the relationship between development and environmental change — the discussion of conflicts and complementarities, reasons for environmental degradation as a result of economic development process-reference to the economic activities and the factors which have led to the environmental degradation, economic incentives/disincentives for environmental protection — a discussion about what effective measures may be useful for environmental protection, problems associated with managing the environment in growing economy – a discussion of what effective instruments can be used in economic decision making which favours adequate environmental management, the possible roles for government — a discussion which highlights the rationale, justification and the effective modes of government intervention for environmental management, and finally the economic activities and the environment in Asia and the Pacific – a discussion on the environmental condition of the region and citation of few cases which generate lessons of experience.

RELATIONSHIP BETWEEN DEVELOPMENT AND ENVIRONMENTAL CHANGE

The recently recognized interdependence between natural environment and economic growth has opened up new paradigm of environmental resource management. This recognition, however, necessiates for a sound national investment planning with adequate treatment to environmental assets. This means an additional investment required for environmental management through which an increased efficiency in resource use can be obtained in each economic activity. Many developed countries have already adopted the procedure of environmental auditing in this regard. By regulating human activities in consistence with the stock of environmental assets, maximum economic benefits can be generated with the least possible costs. Careful national and sectoral decision making is necessary in this process.

There are many tradeoffs between income growth and environmental protection which need careful cost benefit analysis. But evidence suggest that gains from protecting environment are often high and that costs in foregone income are modest if appropriate policies are adopted. Policies when they are focused at underlying causes and incentive oriented are found more effective.

Sound environmental policies act as complementary to economic growth and development. Because in both rural and urban areas it is the poorest group of people who are affected by environmental hazards and any environmental action plan has redistributed advantage to the poor. The costs of protecting and improving environment may be high in absolute terms, but they are modest in comparison with their benefits and with potential aims from economic growth. Improving environment may raise investment rate by 2 to 3 percent of GDP, but will have far reaching impact on stabilization of soil, increased protection of forest, improved air and water quality, etc.

REASONS FOR ENVIRONMENTAL DEGRADATION AS A RESULT OF ECONOMIC DEVELOPMENT PROCESS

The major reasons for the environmental degradation associated with economic development process include the following :

Population Growth and Urbanization

The basic cause for environmental degradation and resource depletion is the population growth because it requires means of living; food, cloth, shelter etc. which generate serious pressure on natural resource stock. When increase in population is particularly in the urban areas due to the expansion of industrial and commercial activities in these areas, solid waste disposal problem becomes a major concern.

Increase in Production

Natural resources are extracted in the production process. As the economy expands, greater utilization of natural resources create new and expand the existing productive forces. This process ultimately results into mass pollution.

International Trade

Rapid increase in the flow of goods and services and raw materials also generate environmental problems which flow from one country to another. For example, the import of plastic materials into Nepal from other countries has serious environmental problem in recent years.

Technological Progress

The inventions and innovations which lead to application of science in the sphere of production has led to certain disturbance to the

existing ecosystem. For example, dam construction in the river system has led to destruction of some of the migratory fish species.

Poverty

There is close correlation between environmental degradation and poverty. Poverty is both the cause and effect of environmental degradation particularly in Asia and the Pacific region. Because majority of the poor depend on natural resources for their livelihood. The over-exploitation of these resources lead to further environmental degradation.

Market Failure

When market fails to allocate resources efficiently under imperfect conditions, this leads to divergence between private cost and social cost in production and consumption leading to externalizes. Common property resources are neglected for conservation, such resources are fisheries, ground water etc. This leads to maximize benefits from the resource use. As public goods are not efficiently produced by private producers, resource allocation is not efficient in this area.

ECONOMICS OF INCENTIVES/DISINCENTIVES FOR ENVIRONMENTAL PROTECTION

The primary requirement for introducing economic incentives and disincentives for environmental management, protection is the pricing of the environmental assets. When qualification is made of the market value of the natural products, market forces themselves act as incentives or disincentives for the management of the natural environment.

One way of government intervention in the sphere of proper management of natural environment in this contest is through tax/subsidy system e.g. a certain charge to factory for emissing a particular fume or effluent or subsidy to certain production units which are environmentally non-pollutant. As profit motivd is the prime factor in the production process a firm is compelled to decide about the best possible alternative which makes it produce the output with minimum cost per unit.

Here the basic point is the correct pricing of environmental assets for the efficient allocation of these resources in the production activities. When environmental assets are priced appropriately, they are treated like other goods and services under the principle of marginal pollution reduction cost equaling marginal environmental destruction cost.

PROBLEMS ASSOCIATED WITH MANAGING THE ENVIRONMENT IN A GROWING ECONOMY

For the environmentalists, basic reasons for environmental degradation originate from economic activities e.g. energy consumption, improper management of industrial wastes etc.

But the economists generally believe that it is poverty which is the root cause of environmental degradation. It is poverty which forces human beings to disturb sound natural eco-system. So the main argument here is that the economic growth can effectively reduce poverty and, therefore, environmental degradation.

However, recent thinking is that environmental protection and economic development can be complemented by mutually supportive planning as stated in the *Conservation Strategy* Report of UNEP (1980). Also the Brundtland Report (1987) under the name *Our Common Future* prepared by the World Commission on Environment and Development stated clearly that a sound environment policy is that which meets the needs of the present generation without compromising the ability of future generations to meet their needs.

The major issues raised in the Brundtland Report include the following :

- If harnessed and efficiently managed, the resources of the world are sufficient to satisfy the needs of all living beings.
- Both poverty and affluence may create problems for environmental protection.
- Growth, development and environmental conservation are compatible, interdependent and mutually supportive rather than conflicting concepts.
- A new era of economic growth is possible based on policies that sustain and expand the environmental resource base. Such growth is absolutely essential to relieve great poverty that is deepening in much of developing world.
- International economic relationship pose a particular environment management particularly for natural resource exporting developing countries as at least half of their GNP is derived from international trade which over exploit their environmental resource base. In this context World Bank can support environmentally sound projects and policies. Also multinational companies can play an important role in sustainable development through strengthening negotiation capacity of developing countries.

The economics of environmental management emphasizes, therefore, that the natural capital should be mobilized in such a careful way for human use that there is almost no negative impact. The smooth maintenance of life supporting eco-system is the basic pre-requisite for environmental sustainability.

Pearce and Turner (1990) have put forward that the policy decision makers should be careful about utilizing the natural resources in such a way that it should not exceed the regeneration rate and maintain the waste flow rate below or equal to absorptive capacity of the environment.

For practical purpose, the economics of natural resource management emphasizes that sustainable net benefits of economic development should be maximized while maintaining the quality of the natural resources. As the economics of environmental management should maximize the value of environmental assets, this objective itself aims at minimizing the loss.

It is difficult to deal with environmental problem for economic theory in the context of a growing and restructured economy because it is impossible to buy and sell environmental assets in the market due to absence of pricing system for them. The environmental goods are not traded in the market — environmental degradation is simply taken as an eternality problem and the decision makers in the market exclude environment while making decisions. Therefore, the first criterion for the use of economics here is to mobilize the natural capital. Valuation of the environmental assets should be made with proper policies. Some of the appropriate policy tools include Benefit-Cost Analysis, Environmental Gross National Product, economic incentives etc.

The Benefit-Cost Analysis

The Benefit-Cost Analysis is a technique to make decisions about the selection of alternative projects based on their benefits and cost. This tool can be effectively used in determining the acceptable limits of environmental pollution and emissions. By quantifying both environmental benefits and costs, the benefit cost analysis can be used in the environmental impact analysis.

The pre-conditions for sustainable development include careful examination of carrying capacity of environment based on development planning process and structural changes in the economic sectors. Project appraisals should be geared towards identifying and valuing specific projects which specifically recognize environment management aspects which include :

- Bio-technological improvement, land use planning compatible with eco-system, organic manure in agriculture.
- Save and recycle raw materials and energy substitution of ecologically harmful raw materials and products in industry.
- Reduction in fuel consumption of motor vehicle, computation efficient engines, efficient public transport in transport system.
- Environmentally capable building materials, saving of land and energy by appropriate design and orientation, labour intensive technique etc. in construction.

Environmental Gross National Product (EGNP)

GNP calculation is known as an important tool to estimate the share of different sectors of the economy in the total national output with reference to aggregate demand and supply adjustments. Currently GNP

of a country is calculated without counting on environmental assets. Therefore, the GNP calculation should incorporate natural resource account by developing appropriate valuing techniques. Several approaches have been developed, notably in Norway and France regarding this. Recent attempts to apply natural resource accounting to developing countries, particularly in Indonesia, for the estimation of natural resources was mainly for forests petroleum and soils. In Costa Rica, it was estimated for fisheries and forests. In China natural national account was calculated for minerals. However, these attempts are at the experimental stage in which the estimates are applied to conventionally measured income to derive a measure of net income.

POSSIBLE ROLES FOR GOVERNMENT

The world has learned over the past two decades to rely more on market and less on government. But environmental protection is one area in which government must maintain a central role. Because private markets provide little or no incentive for curbing pollution. For example : dumping of unsanitary wastes in public places, or overuse of land, air pollution in the cities necessitate for public action.

Some recommended government policies and strategies for environmentally sound and sustainable development may include the following :

- Reasonable rise in the budgetary provision for health and education to the extent of at least 5 percent of GDP in Asia and the Pacific.
- A sound balance between population growth, health care measures and economic opportunities with necessary institutional arrangement must be established.
- Off-farm employment generation, particularly the labour intensive production activities should be encouraged in rural areas to supplement farm income, and to reduce human over-exploitation of natural resources. This should be done throughout targeted credit programme in the rural areas.
- Removal of price distortions, particularly on fossil fuel may be effective in reducing air pollution. Encouragement to non-polluting public transport system in the urban areas also can be an effective means for sound and sustainable management of environmental assets.
- Provision for the community/joint ownership of local common resources e.g. forest, pasture land, drinking water and irrigation water supply systems, can be effective for sustainable management of local resources.
- Fixation of standards for industrial and urban pollution, monitoring of public and private production activities and levying of proper charges and penalties on pollution units with proper legal and financial safety to the affected individual or community, are effective strategies to be adopted.

— Promotion of energy saving and less polluting practices and technologies at the household and industrial level e.g. improved cooking stoves in houses and elimination of steam and power leaks etc. in factories can be more effective for environmental protection.

ECONOMIC ACTIVITIES AND THE ENVIRONMENT IN ASIA AND THE PACIFIC

The Asia and the Pacific region which accounted for over 50 percent of the world population (see annex tables) in 1990 has also shown a tendency to accommodate almost the same proportion of the global population in the projected population figure for 2030. But this region has a share of less than 6 percent in the world GDP. Also the GNP per capita in this region is only US $ 400 compared to a global average of US $ 4200.

The water availability in this region is abundant but the industrial and domestic use of water is much less compared to other regions and at the global scale. Regarding energy consumption, the region's share is 9.3 percent only in liquid fuel consumption but it rapidly grew at a rate of 5.6 percent between 1980 and 1989 in South Asia against only 0.6 percent at the world scale. Similarly solid fuel consumption in the region is around 25 percent and the consumption rate was over 6 percent per annum between 1980 and compared to only 3.2 percent growth rate at the world scale. The very low gas and primary electricity consumption (less than 5 percent of the total world consumption) and almost 50 percent of the world's total fuel and charcoal consumption in the Asia and the pacific region suggest that the burden on eco-system, mainly the forest resources, is very high in the region and it has increased almost parallel with the world consumption between 1980 and 1989.

Regarding carbon dioxide emission, East Asia and the Pacific had tremendous increase from 157 tons in 1965 to 837 tons in 1989.

All these environmental indicators suggest that the environmental protection measures for sustainable development are very urgently needed in the very Asia and the Pacific region. The issues and options and the suggestive measures explained in the previous sections have highlighted how economics should be utilized in the management of sustainable economic growth in this region.

Following section records some lessons derived from the experience of economic development and environment in the Asia and the Pacific region.

Case 1 : Lessons of Irrigation Water Supply and the Aral Sea in Central Asian Region

The excessive diversion of water from Amy Darya and Syr Darya rivers for irrigation purposes has heavily reduced the total river run off into the Aral Sea in Kazakhstan, Tajikistan and other central Asian

regions. The diversion of water has benefitted the farmers but at heavy environmental cost. The sea level has fallen below the minimum required level to growing cotton. It has also destroyed the substantial fishing industry and a variety of fauna. The sea is converting itself into a saline lake. Soils have been poisoned with salt, over watering has turned pasture land into bogs, water supplies have become polluted by pesticide and fertilizer residues. The regional population of 35 million is growing at 2.7 percent per annum and the region is becoming dependent on specialized agriculture, but on unsustainable manner. Now the problem is that any rapid reduction in irrigation water will reduce living standard unless irrigation water is diversified to other farming practices. This is one of the serious examples indicating the need to combine development with sound environmental measure.

Case 2 : Lessons of Durian Fruit Harvest in Malaysia

In Malaysia, the supply of Durian Fruit in 1970 began to decline which threatened the US $ 100 million fruit industry. The reason discovered was that the flowers of the durian tree was pollinated by a species of bat whose population was on severe decline. Due to the reduction in flowering trees in mangrove swamps and the heavy shrimp farming in the swamp area, food for the bats was reduced. Also a local cement factory destroyed the limestone caves where the bats were roosting. When the cement factory was closed, the population of the bats began to increase slowly.

Case 3 : Lessons of Liberalized Trade and Environmental Problem

Cassava export to EC from Thailand caused soil erosion in Thailand. Environmental effects of trade liberalization was also observed in the contest of frog leg export from India to other countries which increased the incidence of pests destroying rice plants in India.

Case 4 : Lessons of Forest Management in Nepal

The World Development Report (1992) states that a forest management project was introduced in Nepal to reduce deforestation by planting trees and bushes suitable for fuelwood and fodder and to improve scrubland and timbers land. When market value of two products, milk and fertilizer alone were estimated, with price for use values alone, without counting on benefits from control of soil erosion and flooding gave the project a rate of return of about 9 percent.

Case 5 : Lessons of Biodiversity Protection Project in the Philippines

A loan package of US $ 224 million was approved by the World Bank in the Philippines for the protection of the bio-diversity. The largest threat to the biodiversity in the Philippines is the encroachment

by land hungry farmers and illegal commercial logging. The project is aimed to address the issues relating to the sustainable patterns of resource use by small farmers for securing tenure rights and enforcement of improved logging regulations. The Department of Environment and Natural resources, as the executing agency is supporting the network of protected priority area. Such specific projects directly aimed at environmental protection are useful in the management of sound and sustainable environment.

Case 6 : Lessons of Japanese Experience in Curbing Pollution with Rapid Economic Growth

Heavy expenditure for pollution control in Japan by large companies (over 900 billion yen) during 1970s has benefitted the environment protection efforts in recent years by reducing sulfur oxide emission by 83 percent and nitrogen oxide by 29 percent and carbon monoxide by 60 percent. These efforts were mainly made through strong governmental regulations and an understanding between the companies and the communities.

The World Development Report 1992 states that three lessons of Japanese experience my be useful in this contest i.e. establishment of a national policy framework through legal provision and pollution control laws; negotiation at the local/community level about environmental auditing by the companies; and flexibility in setting emission levels and promote self regulation to make firms more sensitive to local environment conditions.

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ANNEX TABLES ON ASIA AND THE PACIFIC

Table 1
Population and Average Annual Growth

Region	Population in Million			Growth in Percentage		
	1990	2000	2030	1980-1990	1990-2000	2000-2030
East Asia and Pacific	1577	1818	23789	1.6	1.4	0.9
South Asia	1148	1377	1978	2.2	1.8	1.1
	2725 (51.6%)	3195 (51.6)	4356 (49.1%)			
World	5284	6185	8869	1.7	1.6	1.2

Table 2
GNP, GNP Per Capita and Growth of GNP Per Capita

Billion $ US

Region	GNP 1990	Population 2000	1990 GNP Per Capita $ US	Growth Rate of Per Capita GNP (%)
East Asia & Pacific	939	1577	600	5.3
South Asia	383	1148	330	2.6
	1322 (5.9%)	2725 (51.6%)	400 (Average)	
World	22173	5284	4200	0.5

Table 3
Water Availability

Region	Annual Renewal Water Cubic Kilometer	Total Annual Water Withdrawal Cubic Kilometer (Percentage of Total)	Per Capita Annual Renewable Water (Cubic Meter)	Sectoral Withdrawal as Percentage Share of Total Water		
				Agriculture	Domestic	Industry
East Asia and Pacific	7915	8	5009	86	6	8
South Asia	4895	12	4236	94	2	3
World	40856	7	7744	69	9	22

Table 4
Carbon Dioxide Emission from Fossil Fuel and Cement Manufacture

Region	Total emission (in tons)		Average Annual Growth in Percentage	Share of Omission from different sources of 1989		
	1965	1989	1980-89	Solid	Liquid	Gas
East Asia and Pacific	157	847	5.7	70	22	2
South Asia	47	201	7.0	64	25	6
World	3012	5812	1.8	42	38	16

Table 5
Consumption of Resources

(Million of Tons Average Annual)

Region	Liquid Fuel	Average Annual growth (%)	Solid Fuel	Average Annual growth (%)	Gas	Average Annual Growth (%)	Pri-mary Elec.	Aerage annual Growth	Fuel and Char-coal	
	1989	1980-89	1989	1980-89	1989	1980-89	1989	1980-89	1989	
East Asia and Pacific	219	2.9	543	6.6	17	3.8	49	11.0	98	19
South Asia	69	5.6	116	6.5	8	9.3	20	2.9	76	2.3
World	3081	0.6	2321	3.2	1253	10.1	985	5.6	399	2.2

Source : For all tables, *World Development Report 1992*, World Bank.