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PAPER - IV (A)

# ECONOMICS OF SOCIAL SECTOR AND ENVIRONMENT

MADHYA PRADESH BHOJ (OPEN) UNIVERSITY
RAJA BHOJ MARG (KOLAR ROAD), BHOPAL

POST GRADUATE PROGRAMME
M.A. (PREVIOUS) ECONOMICS

# Paper - IV (A)
# M.A. (PREVIOUS) ECONOMICS

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| Unit 1 | Elements of Economics of social sector and environment |
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PAPER - IV (A) M.A. (PREVIOUS) ECONOMICS

# BLOCK - I

## Economics of Social Sector and Environment

### INTRODUCTION

Balanced development of an economy has become a major area of concern for the present day .....ask..... Economic development is causing environmental loss. Therefore the present day plerrers are facing challenging last of maintaining an equi brier between economic development and development of social sector on the one hand and Environment problems on the other.

The present book presents a comprehensive study of Economics of social sector and environments

The Present books studies the problems of social sector and environment in four parts.

Block Familiars both some elementary concepts of welfare Economics and social sector. Thus block also deals with measurement of environmental values alongwith elements of economics of social sector and environment. Environmental policy and regulators have also been discovered alongwith structural trade and environment in .....ask....., regime.

First block makes comprehensive study of Economics of social sector and Environmental values. It through light on theory of environmental valuator including the total economic value and spells out the environmental policy and regulator.

Second blocks analysis theories and approaches to natural resource management both renewable and non renewable. It also throws light in new economics policies and environment.

Third block deals with environmental and natural resources problem in India, forest management and social forestry.

Mechanism for environment regulation in India is discussed with environmental law inforcement.

Block 4 deals with Economics of Education and Health Cost first analysis of education. Need for health care and its planning in development and developing countries.

# BLOCK 1 WELFARE ECONOMICS, SOCIAL SECTORS AND MEASUREMENT OF ENVIRONMENTAL VALUES

In block 1 we will familiarize you with some elementary concepts of welfare economics and social sector. The block also deals with measurement of environmental values using appropriate measures that are being used across the globe.

This block has three units.

Unit 1 presents the elements of economics of social sector and environment. First we discussed Pareto optimality and competitive equilibrium followed by Fundamental theorems of welfare economics. Other areas of discussion were Externalities and market inefficiency; Externalities and missing markets; the property rights and Externalities; Non convexities and Externality. Pareto optimal provision for public goods will be discussed in later sections.

Unit 2 deals with measurement of environmental values. It throws light the theory of environmental valuation including the total economic value. Unit also discusses different values like direct and indirect values that have the great relevance in economics of environment further the unit reveal various Environment valuation techniques to help readers have the clear understanding of these techniques.

Unit 3 spells out the Environmental policy and regulations. It discusses in depth, the environmental policy instruments and Government monitoring and enforcement of environmental regulations in different nations. International trade and environment in WTO regime have been discussed at last in the unit.

# UNIT 1

# ELEMENTS OF ECONOMICS OF SOCIAL SECTOR AND ENVIRONMENT

**Objectives**

**After studying this unit, you should be able to understand and appreciate:**

- The concepts of Pareto optimality and competitive equilibrium
- Relevance of fundamental theorems of welfare economics
- Te approach to externalities in context of market inefficiency, missing markets, property rights and non convexities
- Pareto optimal provisions for public goods

**Structure**

1.1 Introduction

1.2 Pareto optimality and competitive equilibrium

1.3 Fundamental theorems of welfare economics

1.4 Externalities and market inefficiency

1.5 Externalities and missing markets

1.6 The property rights and Externalities

1.7 Non convexities and Externality

1.8 Pareto optimal provision for public goods

1.9 Summary

1.10 Further readings

## 1.1 INTRODUCTION

Social welfare refers to the overall welfare of society. With sufficiently strong assumptions, it can be specified as the summation of the welfare of all the individuals in the society. Welfare may be measured either cardinally in terms of "utils" or dollars, or measured ordinally in terms of Pareto efficiency. The cardinal method in "utils" is seldom used in pure theory today because of aggregation problems that make the meaning of the method doubtful, except on widely challenged underlying assumptions. In applied

welfare economics, such as in cost-benefit analysis, money-value estimates are often used, particularly where income-distribution effects are factored into the analysis or seem unlikely to undercut the analysis.

On the other hand, welfare economics is a branch of economics that uses microeconomic techniques to simultaneously determine allocative efficiency within an economy and the income distribution associated with it. It analyzes *social welfare*, however measured, in terms of economic activities of the individuals that comprise the theoretical society considered. As such, individuals, with associated economic activities, are the basic units for aggregating to social welfare, whether of a group, a community, or a society, and there is no "social welfare" apart from the "welfare" associated with its individual units. Some main elements of welfare economics with reference to social sector and environment will be discussed in this unit.

## 1.2 PARETO OPTIMALITY AND COMPETETIVE EQILIBRIUM

Pareto efficiency, or Pareto optimality, is an important concept in economics with broad applications in game theory, engineering and the social sciences. The term is named after Vilfredo Pareto, an Italian economist who used the concept in his studies of economic efficiency and income distribution. Informally, Pareto efficient situations are those in which any change to make any person better off is impossible without making someone else worse off.

Given a set of alternative allocations of, say, goods or income for a set of individuals, a change from one allocation to another that can make at least one individual better off without making any other individual worse off is called a Pareto improvement. An allocation is defined as Pareto efficient or Pareto optimal when no further Pareto improvements can be made. Such an allocation is often called a strong Pareto optimum (SPO) by way of setting it apart from mere "weak Pareto optima" as defined below.

Formally, a (strong/weak) Pareto optimum is a maximal element for the partial order relation of Pareto improvement/strict Pareto improvement: it is an allocation such that no other allocation is "better" in the sense of the order relation.

Pareto efficiency does not necessarily result in a socially desirable distribution of resources, as it makes no statement about equality or the overall well-being of a society.

## 1.2.1 PARETO EFFICIENCY IN ECONOMICS

An economic system that is Pareto inefficient implies that a certain change in allocation of goods (for example) may result in some individuals being made "better off" with no individual being made worse off, and therefore can be made more Pareto efficient through a Pareto improvement. Here 'better off' is often interpreted as "put in a preferred position." It is commonly accepted that outcomes that are not Pareto efficient are to be avoided, and therefore Pareto efficiency is an important criterion for evaluating economic systems and public policies.

If economic allocation in any system (in the real world or in a model) is not Pareto efficient, there is theoretical potential for a Pareto improvement — an increase in Pareto efficiency: through reallocation, improvements to at least one participant's well-being can be made without reducing any other participant's well-being.

In the real world ensuring that nobody is disadvantaged by a change aimed at improving economic efficiency may require compensation of one or more parties. For instance, if a change in economic policy dictates that a legally protected monopoly ceases to exist and that market subsequently becomes competitive and more efficient, the monopolist will be made worse off. However, the loss to the monopolist will be more than offset by the gain in efficiency. This means the monopolist can be compensated for its loss while still leaving an efficiency gain to be realized by others in the economy. Thus, the requirement of nobody being made worse off for a gain to others is met.

In real-world practice, the compensation principle often appealed to is hypothetical. That is, for the alleged Pareto improvement (say from public regulation of the monopolist or removal of tariffs) some losers are not (fully) compensated. The change thus results in distribution effects in addition to any Pareto improvement that might have taken place. The theory of hypothetical compensation is part of Kaldor-Hicks efficiency, also called Potential Pareto Criterion. (Ng, 1983).

Under certain idealized conditions, it can be shown that a system of free markets will lead to a Pareto efficient outcome. This is called the first welfare theorem. It was first demonstrated mathematically by economists Kenneth Arrow and Gerard Debreu. However, the result does not rigorously establish welfare results for real economies because of the restrictive assumptions necessary for the proof (markets exist for all

possible goods, all markets are in full equilibrium, markets are perfectly competitive, transaction costs are negligible, there must be no externalities, and market participants must have perfect information). Moreover, it has since been demonstrated mathematically that, in the absence of perfect information or complete markets, outcomes will generically be Pareto inefficient (the Greenwald-Stiglitz Theorem).

**Pareto frontier**

Given a set of choices and a way of valuing them, the Pareto frontier or Pareto set is the set of choices that are Pareto efficient. The Pareto frontier is particularly useful in engineering: by restricting attention to the set of choices that are Pareto-efficient, a designer can make tradeoffs within this set, rather than considering the full range of every parameter.

**The Pareto frontier is defined formally as follows.**

Consider a design space with n real parameters, and for each design-space point there are m different criteria by which to judge that point. Let $f : \mathbb{R}^n \to \mathbb{R}^m$ be the function which assigns, to each design-space point x, a criteria-space point f(x). This represents the way of valuing the designs. Now, it may be that some designs are infeasible; so let X be a set of feasible designs in $\mathbb{R}^n$, which must be a compact set. Then the set which represents the feasible criterion points is f(X), the image of the set X under the action of f. Call this image Y.

Now construct the Pareto frontier as a subset of Y, the feasible criterion points. It can be assumed that the preferable values of each criterion parameter are the lesser ones, thus minimizing each dimension of the criterion vector. Then compare criterion vectors as follows: One criterion vector y strictly dominates (or "is preferred to") a vector y* if each parameter of y is no greater than the corresponding parameter of y* and at least one parameter is strictly less: that is, $y_i \leq y^*_i$ for each i and $y_i < y^*_i$ for some i. This is written as $y \succ y^*$ to mean that y strictly dominates y*. Then the Pareto frontier is the set of points from Y that are not strictly dominated by another point in Y.

Formally, this defines a partial order on Y, namely the (opposite of the) product order on $\mathbb{R}^m$ (more precisely, the induced order on Y as a subset of $\mathbb{R}^m$), and the Pareto frontier is the set of maximal elements with respect to this order.

Algorithms for computing the Pareto frontier of a finite set of alternatives have been studied in computer science. There, this task is known as the maximum vector problem or as skyline query.

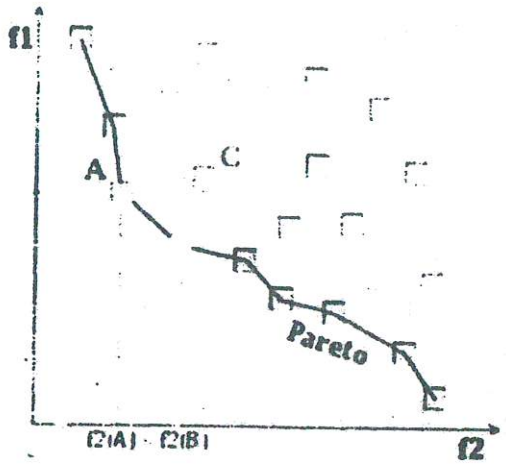


**Figure 1**

Example of a Pareto frontier. The figure points represent feasible choices, and smaller values are preferred to larger ones. Point C is not on the Pareto Frontier because it is dominated by both point A and point B. Points A and B are not strictly dominated by any other, and hence do lie on the frontier.

**Relationship to marginal rate of substitution**

An important fact about the Pareto frontier in economics is that at a Pareto efficient allocation, the marginal rate of substitution is the same for all consumers. A formal statement can be derived by considering a system with m consumers and n goods, and a utility function of each consumer as zi = fi(xi) where $x^i = (x_1^i, x_2^i, \ldots, x_n^i)$ is the vector of goods, both for all i. The supply constraint is written $\sum_{i=1}^{m} x_j^i = b_j^0$ for $j = 1, \ldots, n$. To optimize this problem, the Lagrangian is used:

$$L(x, \lambda, \Gamma) = f^1(x^1) + \sum_{i=2}^{m} \lambda_i (z_i^0 - f^i(x^i)) + \sum_{j=1}^{n} \Gamma_j (b_j^0 - \sum_{i=1}^{m} x_j^i)$$

where λ and Γ are multipliers.

Taking the partial derivative of the Lagrangian with respect to one good, i, and then taking the partial derivative of the Lagrangian with respect to another good, j, gives the following system of equations:

$\frac{\partial L}{\partial x_j^1} = f_{x_j^1}^1 - \Gamma_j^0 = 0$ for j=1,...,n. $\frac{\partial L}{\partial x_j^i} = -\lambda_i f_{x_j^i}^i - \Gamma_j^0 = 0$ for i = 2,...,m and j=1,...,m,

where fx is the marginal utility on f' of x (the partial derivative of f with respect to x).

$\frac{f_{x_j^i}^i}{f_{x_n^i}^i} = \frac{f_{x_j^k}^k}{f_{x_n^k}^k}$ for i,k=1,...,m and j,s=1,...,n

**Weak and strong Pareto optimum**

A so-called weak Pareto optimum (WPO) nominally satisfies the same standard of not being Pareto-inferior to any other allocation, but for the purposes of weak Pareto optimization, an alternative allocation is considered to be a Pareto improvement only if the alternative allocation is strictly preferred by all individuals (i.e., only if all individuals would gain from a transition to the alternative allocation). In other words, when an allocation is WPO there are no possible alternative allocations whose realization would cause every individual to gain.

Weak Pareto-optimality is "weak[er]" than strong Pareto-optimality in the sense that the conditions for WPO status are "weaker" than those for SPO status: Any allocation that can be considered an SPO will also qualify as a WPO, while the reverse does not hold: a WPO allocation won't necessarily qualify as SPO.

Under any form of Pareto-optimality, for an alternative allocation to be Pareto-superior to an allocation being tested -- and, therefore, for the feasibility of an alternative allocation to serve as proof that the tested allocation is not an optimal one -- the feasibility of the alternative allocation must show that the tested allocation fails to satisfy at least one of the criteria whose conjunction (i.e., whose being true all at once) is necessary and sufficient to render the tested allocation Pareto-optimal. The difference between the weak and strong versions of Pareto-optimality lies in that when considered as a set, the conditions necessary and sufficient to make an allocation weakly Pareto-optimal constitute a mere subset of the set of conditions necessary and sufficient to make an allocation strongly Pareto-optimal. In other words, when one compares the two lists of conditions side by side, one finds that a) the WPO list contains some but not all of the conditions found on the SPO list and b) the WPO list contains no conditions not found on the SPO list). The logical consequence may be paraphrased in both of two ways, the only difference being one of emphasis and resulting from how one distributes the negation: a)

Every allocation that satisfies the conjunction of the conditions for SPO status also (and by virtue of its satisfying that conjunction) satisfies the conjunction of the conditions for WPO status, and b) the conjunction of conditions for WPO status disqualifies only a subset of the allocations disqualified by the conjunction of conditions for SPO status. To use the language of combat as a metaphor, the conjunction of conditions for WPO status can "defeat" only a subset of the allocations that the conjunction of conditions for SPO status can "defeat." One may apply the same metaphor to describe the set of requirements for WPO status as being "weaker" than the set of requirements for SPO status. (Indeed, because the SPO set entirely encompasses the WPO set, with respect to any property the requirements for SPO status are of strength equal to or greater than the strength of the requirements for WPO status. Therefore, the requirements for WPO status are not merely weaker on balance or weaker according to the odds; rather, one may describe them more specifically and quite fittingly as "Pareto-weaker.")

Note that when one considers the requirements for an alternative allocation's superiority according to one definition against the requirements for its superiority according to the other, the comparison between the requirements of the respective definitions is the opposite of the comparison between the requirements for optimality: To demonstrate the WPO-inferiority of an allocation being tested, an alternative allocation must falsify at least one of the particular conditions in the WPO subset, rather than merely falsify at least one of either these conditions or the other SPO conditions. Therefore, the requirements for weak Pareto-superiority of an alternative allocation are harder to satisfy -- i.e., "stronger" -- than are the requirements for strong Pareto-superiority of an alternative allocation.)

It further follows that every SPO is a WPO (but not every WPO is an SPO): Whereas the WPO description applies to any allocation from which every feasible departure results in the NON-IMPROVEMENT of at least one individual, the SPO description applies to only those allocations that meet both the WPO requirement and the more specific ("stronger") requirement that at least one non-improving individual exhibit a specific type of non-improvement, namely DOING WORSE.

The "strong" and "weak" descriptions of optimality continue to hold true when one construes the terms in the context set by the field of semantics: If one describes an allocation as being a WPO, one makes a "weaker" statement than one would make by describing it as an SPO: If the statements "Allocation X is a WPO" and "Allocation X is a SPO" are both true, then the former statement is less controversial than the latter in that to defend the latter, one must prove everything one must prove to defend the former "and then some." By the same token, however, the former statement is less informative or contentful in that it "says less" about the allocation; that is, the former statement contains. implies, and (when stated) asserts fewer constituent propositions about the allocation.

**Constrained Pareto efficiency**

The condition of Constrained Pareto optimality is a weaker version of the standard condition of Pareto Optimality employed in Economics which accounts for the fact that a potential planner (i.e. the government) may not be able to improve upon a decentralized market outcome, even if that outcome is inefficient. This will occur if he is limited by the same informational or institutional constraints as individual agents.

The most common example is of a setting where individuals have private information (for example a labor market where own productivity is known to the worker but not to a potential employer, or a used car market where the quality of a car is known to the seller but not to the buyer) which results in moral hazard or adverse selection and a sub-optimal outcome. In such a case, a planner who wishes to improve the situation is unlikely to have access to any information that the participants in the markets do not have. Hence he cannot implement allocation rules which are based on idisoyncratic characteristics of individuals, for example "if a person is of type A, they pay price p1, but if of type B, they pay price p2" (see Lindahl prices). Essentially, only anonymous rules are allowed of the sort "Everyone pays price p" or rules based on observable behavior; "if any person chooses x at price px then they get a subsidy of ten dollars, and nothing otherwise". If there exists no allowed rule that can successfully improve upon the market outcome, then that outcome is said to be Constrained-Pareto optimal.

Note that the concept of Constrained Pareto optimality assumes benevolence on the part of the planner and hence it is distinct from the concept of government failure.

which occurs when the policy making politicians fail to achieve an optimal outcome simply because they are not necessarily acting in the public's best interest.

**Criticism**

When Pareto efficiency is used as a tool in politics to determine whether a situation can be improved upon or not, there is no consideration of the equity of resource allocation. It may be that one economic agent owns all of the world's resources; it would be impossible to make anyone else better off without taking something away from this agent. Assuming all resources benefit the rich agent's well-being, this situation is described as "Pareto optimal", even though it may be seen as inequitable.

More generally. it can be misleading, in that "not Pareto optimal" implies "can be improved" (making someone better off without hurting anyone), but "Pareto optimal" does not imply "cannot be improved" by some measure—it only implies that someone must receive less. Thus if an allocation is not Pareto optimal, it means that one can improve it, but does not mean that one should categorically reject it for any arbitrary Pareto optimal solution, as many of those Pareto optimal solutions will not be Pareto improvements.

## 1.2.2 THE COMPETETIVE EQULIBRIUM

Competitive market equilibrium is the traditional concept of economic equilibrium, appropriate for the analysis of commodity markets with flexible prices and many traders, and serving as the benchmark of efficiency in economic analysis. It relies crucially on the assumption of a competitive environment where each trader decides upon a quantity that is so small compared to the total quantity traded in the market that their individual transactions have no influence on the prices. Competitive markets are an ideal, a standard that other market structures are evaluated by.

A competitive equilibrium consists of a vector of prices and an allocation such that given the prices, each trader by maximizing his objective function (profit, preferences) subject to his technological possibilities and resource constraints plans to trade into his part of the proposed allocation, and such that the prices make all net trades compatible with one another ('clear the market') by equating aggregate supply and demand for the commodities which are traded.

A simple example is a society where there are only 2 products, bananas and apples, and 2 individuals, Jane and Kelvin. The price of bananas is Pb, and the price of apples is Pa.

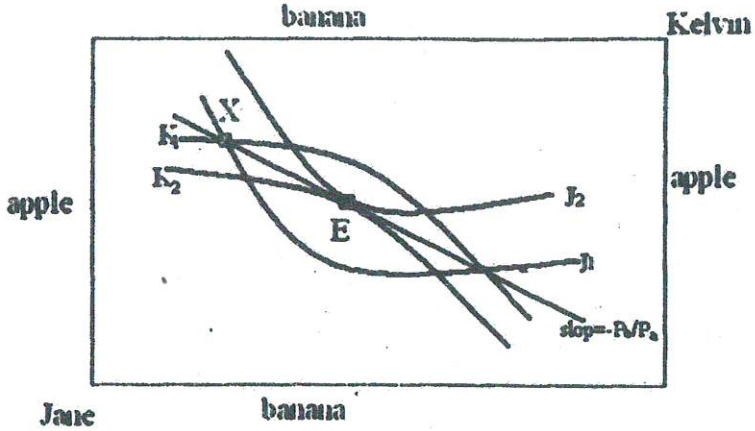


Figure 2

The indifference curves J1 of Jane and K1 of Kelvin first intersect at point X, where Jane has more apples than Kelvin does, Kelvin has more bananas than Jane does, and they are willing to trade with each other at the prices Pb and Pa. After trading both Jane and Kelvin move to an indifference curve which depicts a higher level of utility, J2 and K2. The new indifference curves intersect at point E. The slope of the tangent of both curves equals -Pb/Pa. And the MRSJane=Pb/Pa; MRSKelvin=Pb/Pa. The marginal rate of substitution of Jane equals that of Kelvin. Therefore the 2 individual society reach Pareto efficiency, where there is no way to make Jane or Kelvin better off without making the other worse off.

**The competitive equilibrium and allocative efficiency**

At the competitive equilibrium, the value society places on a good are equivalent to the value of the resources given up to produce it (marginal benefit equals marginal cost). By definition, this ensures allocative efficiency (the additional value society places on another unit of the good is equal to what society must give up in resources to produce it.)

## 1.3 FUNDAMENTAL THEOREMS OF WELFARE ECONOMICS

There are two fundamental theorems of welfare economics. The first states that any competitive equilibrium or Walrasian equilibrium leads to a Pareto efficient allocation of resources. The second states the converse, that any efficient allocation can be sustainable by a competitive equilibrium. Despite the apparent symmetry of the two theorems, in fact the first theorem is much more general than the second, requiring far weaker assumptions.

The first theorem is often taken to be an analytical confirmation of Adam Smith's "invisible hand" hypothesis, namely that competitive markets tend toward the efficient allocation of resources. The theorem supports a case for non-intervention in ideal conditions: let the markets do the work and the outcome will be Pareto efficient. However, Pareto efficiency is not necessarily the same thing as desirability or even more general definitions of "efficiency"; it merely indicates that no one can be made better off without someone being made worse off. There can be many possible Pareto efficient allocations of resources and not all of them may be equally desirable by society.

These ideal conditions, however, collectively known as Perfect Competition, do not exist in the real world. The Greenwald-Stiglitz Theorem, for example, states that in the presence of either imperfect information, or incomplete markets, markets are not Pareto efficient. Thus, in most real world economies, the degree of these variations from ideal conditions must factor into policy choices.

The second theorem states that out of the infinity of all possible Pareto efficient outcomes one can achieve any particular one by enacting a lump-sum wealth redistribution and then letting the market take over. This appears to make the case that intervention has a legitimate place in policy – redistributions can allow us to select from among all efficient outcomes for one that has other desired features, such as distributional equity. However, it is unclear how any real-world government might enact such redistributions. Lump-sum transfers are difficult to enforce and virtually never used, and proportional taxes may have large distortionary effects on the economy since taxes change the relative remunerations of the factors of production, distorting the structure of production. Additionally, the government would need to have perfect knowledge of

consumers' preferences and firms' production functions (which are in fact unknowable) in order to choose the transfers correctly.

### *Proof of the first fundamental theorem*

The first fundamental theorem of welfare economics states that any Walrasian equilibrium is Pareto-efficient. This was first demonstrated graphically by economist Abba Lerner and mathematically by economists Harold Hotelling, Oskar Lange, Maurice Allais, Kenneth Arrow and Gerard Debreu, although the restrictive assumptions necessary for the proof mean that the result may not necessarily reflect the workings of real economies. The only assumption needed (in addition to complete markets and price-taking behavior) is the relatively weak assumption of local nonsatiation of preferences. In particular, no convexity assumptions are needed. More formally, the statement of the theorem is as follows: *If preferences are locally nonsatiated, and if (x*, y*, p) is a price equilibrium with transfers, then the allocation (x*, y*) is Pareto optimal.* An equilibrium in this sense either relates to an exchange economy only or presupposes that firms are allocatively and productively efficient, which can be shown to follow from perfectly competitive factor and production markets.

Suppose that consumer $i$ has wealth $w_i$ such that $\Sigma_i w_i = p \cdot \omega + \Sigma_j p \cdot y_j^*$ where $\omega$ is the aggregate endowment of goods and $y_j^*$ is the production of firm $j$.

Preference maximization (from the definition of price equilibrium with transfers) implies:

$$\text{if } x_i \succ_i x_i^* \text{ then } p \cdot x_i > w_i$$

In other words, if a bundle of goods is strictly preferred to $x_i^*$ it must be unaffordable at price $p$. Local nonsatiation additionally implies:

$$\text{if } x_i \succsim_i x_i^* \text{ then } p \cdot x_i \geq w_i$$

To see why, imagine that $x_i \succsim_i x_i^*$ but $p \cdot x_i < w_i$. Then by local nonsatiation we could find $x_i'$ arbitrarily close to $x_i$ (and so still affordable) but which is strictly preferred to $x_i^*$. But $x_i^*$ is the result of preference maximization, so this is a contradiction.

Now consider an allocation $(x, y)$ that Pareto dominates $(x^*, y^*)$. This means that $x_i \succsim_i x_i^*$ for all $i$ and $x_i \succ_i x_i^*$ for some $i$. By the above, we know $p \cdot x_i \geq w_i$ for all $i$ and $p \cdot x_i > w_i$ for some $i$. Summing, we find:

$$\Sigma_i p \cdot x_i > \Sigma_i w_i = p \cdot \omega + \Sigma_j p \cdot y_j^*$$

Because $y_j$ is profit maximizing we know $\Sigma_j p \cdot y_j^* \geq \Sigma_j p \cdot y_j$, so $\Sigma_i p \cdot x_i > p \cdot \omega + \Sigma_j p \cdot y_j$. Hence, $(x, y)$ is not feasible. Since all Pareto-dominating allocations are not feasible, $(x^*, y^*)$ must itself be Pareto optimal.

### Proof of the second fundamental theorem

The second fundamental theorem of welfare economics states that, under the assumptions that every production set $Y_j$ is convex and every preference relation $\succeq_i$ is convex and locally nonsatiated, any desired Pareto-efficient allocation can be supported as a price *quasi*-equilibrium with transfers. Further assumptions are needed to prove this statement for price equilibriums with transfers. We will proceed in two steps: first we prove that any Pareto-efficient allocation can be supported as a price quasi-equilibrium with transfers, then we give conditions under which a price quasi-equilibrium is also a price equilibrium.

Let us define a price quasi-equilibrium with transfers as an allocation $(x^*, y^*)$, a price vector $p$, and a vector of wealth levels $w$ (achieved by lump-sum transfers) with $\Sigma_i w_i = p \cdot \omega + \Sigma_j p \cdot y_j^*$ (where $\omega$ is the aggregate endowment of goods and $y_j^*$ is the production of firm $j$) such that:

i. $p \cdot y_j \leq p \cdot y_j^*$ for all $y_j \in Y_j$ (firms maximize profit by producing $y_j^*$)
ii. For all $i$, if $x_i \succ_i x_i^*$ then $p \cdot x_i \geq w_i$ (if $x_i$ is strictly preferred to $x_i^*$ then it cannot cost less than $x_i^*$)
iii. $\Sigma_i x_i^* = \omega + \Sigma_j y_j^*$ (budget constraint satisfied)

The only difference between this definition and the standard definition of a price equilibrium with transfers is in statement (ii). The inequality is weak here ($p \cdot x_i \geq w_i$) making it a price quasi-equilibrium. Later we will strengthen this to make a price equilibrium.

Define $V_i$ to be the set of all consumption bundles strictly preferred to $x_i^*$ by consumer $i$, and let $V$ be the sum of all $V_i$. $V_i$ is convex due to the convexity of the preference relation $\succeq_i$. $V$ is convex because every $V_i$ is convex. Similarly $V + \{\omega\}$, the union of all production sets $Y_j$ plus the aggregate endowment, is convex because every $Y_j$ is convex. We also know that the intersection of $V$ and $V + \{\omega\}$ must be empty, because if it were not it would imply there existed a bundle that is strictly preferred to $(x^*, y^*)$ by everyone and is also affordable. This is ruled out by the Pareto-optimality of $(x^*, y^*)$.

These two convex, non-intersecting sets allow us to apply the separating hyperplane theorem. This theorem states that there exists a price vector $p \neq 0$ and a number $r$ such that $p \cdot z \geq r$ for every $z \in V$ and $p \cdot z \leq r$ for every $z \in V + \{\omega\}$. In other words, there exists a price vector that defines a hyperplane that perfectly separates the two convex sets.

Next we argue that if $x_i \succeq_i x_i^*$ for all $i$ then $p \cdot (\Sigma_i x_i) \geq r$. This is due to local nonsatiation: there must be a bundle $x_i'$ arbitrarily close to $x_i$ that is strictly preferred to $x_i^*$ and hence part of $V_i$, so $p \cdot (\Sigma_i x_i') \geq r$. Taking the limit as $x_i' \to x_i$ does not change the weak inequality, so $p \cdot (\Sigma_i x_i) \geq r$ as well. In other words, $x_i$ is in the closure of $V$.

Using this relation we see that for $x_i^*$ itself $p \cdot (\Sigma_i x_i^*) \geq r$. We also know that $\Sigma_i x_i^* \in V + \{\omega\}$, so $p \cdot (\Sigma_i x_i^*) \leq r$ as well. Combining these we find that $p \cdot (\Sigma_i x_i^*) = r$. We can use this equation to show that $(x^*, y^*, p)$ fits the definition of a price quasi-equilibrium with transfers.

Because $p \cdot (\Sigma_i x_i^*) = r$ and $\Sigma_i x_i^* = \omega + \Sigma_j y_j^*$ we know that for any firm $j$:

$$p \cdot (\omega + y_j + \Sigma_h y_h^*) \leq r = p \cdot (\omega + y_j^* + \Sigma_h y_h^*) \text{ for } h \neq j$$

## 1.4 EXTERNALITIES AND MARKET INEFFICIENCY

In economics, an externality or spillover of an economic transaction is an impact on a party that is not directly involved in the transaction. In such a case, prices do not reflect the full costs or benefits in production or consumption of a product or service. An advantageous impact is called an external benefit or positive externality, while a detrimental impact is called an external cost or negative externality. Producers and consumers in a market may either not bear all of the costs or not reap all of the benefits of the economic activity. For example, manufacturing that causes air pollution imposes costs on the whole society, while fire-proofing a home improves the fire safety of neighbors.

In a competitive market, the existence of externalities would cause either too much or too little of the good to be produced or consumed in terms of overall costs and benefits to society. If there exist external costs such as pollution, the good will be overproduced by a competitive market, as the producer does not take into account the external costs when producing the good. If there are external benefits, such as in areas of education or public safety, too little of the good would be produced by private markets as producers and buyers do not take into account the external benefits to others. Here, overall cost and benefit to society is defined as the sum of the economic benefits and costs for all parties involved.


**Figure 3 External costs and benefits**

***Implications***

Standard economic theory states that any voluntary exchange is mutually beneficial to both parties involved in the trade. This is because if either the buyer or the seller would not benefit from the trade, they would refuse it. However, an exchange can cause additional effects on third parties. From the perspective of those affected, these

effects may be negative (pollution from a factory), or positive (honey bees that pollinate the garden). Welfare economics has shown that the existence of externalities results in outcomes that are not socially optimal. Those who suffer from external costs do so involuntarily, while those who enjoy external benefits do so at no cost.

A voluntary exchange may reduce societal welfare if external costs exist. The person who is affected by the negative externality in the case of air pollution will see it as lowered utility: either subjective displeasure or potentially explicit costs, such as higher medical expenses. The externality may even be seen as a trespass on their lungs, violating their property rights. Thus, an external cost may pose an ethical or political problem. Alternatively, it might be seen as a case of poorly-defined property rights, as with, for example, pollution of bodies of water that may belong to no-one (either figuratively, in the case of publicly-owned, or literally, in some countries and/or legal traditions).

On the other hand, an external benefit would increase the utility of third parties at no cost to them. Since collective societal welfare is improved, but the providers have no way of monetizing the benefit, less of the good will be produced than would be optimal for society as a whole. Goods with positive externalities include education (believed to increase societal productivity and well-being; but controversial, as these benefits may be internalized), health care (which may reduce the health risks and costs for third parties for such things as transmittable diseases) and law enforcement. Positive externalities are often associated with the free rider problem. For example, individuals who are vaccinated reduce the risk of contracting the relevant disease for all others around them, and at high levels of vaccination, society may receive large health and welfare benefits; but any one individual can refuse vaccination, still avoiding the disease by "free riding" on the costs borne by others.

There are a number of potential means of improving overall social utility when externalities are involved. The market-driven approach to correcting externalities is to "internalize" third party costs and benefits, for example, by requiring a polluter to repair any damage caused. But, in many cases internalizing costs or benefits is not feasible, especially if the true monetary values cannot be determined.

The monetary values of externalities are difficult to quantify, as they may reflect the ethical views and preferences of the entire population. It may not be clear whose

preferences are most important, interests may conflict, the value of externalities may be difficult to determine, and all parties involved may try to influence the policy responses to their own benefit. An example is the externalities of the smoking of tobacco, which can cost or benefit society depending on the situation. Because it may not be feasible to monetize the costs and benefits, another method is needed to either impose solutions or aggregate the choices of society, when externalities are significant. This may be through some form of representative democracy or other means. Political economy is, in broad terms, the study of the means and results of aggregating those choices and benefits that are not limited to purely private transactions.

Laissez-faire economists such as Friedrich Hayek and Milton Friedman sometimes refer to externalities as "neighborhood effects" or "spillovers", although externalities are not necessarily minor or localized:

***Examples of different kind of externalities***

*Various types of externalities are discussed as following:*

**Negative**

Many **negative externalities** (also called "external costs" or "external diseconomies") are related to the environmental consequences of production and use. The article on environmental economics also addresses externalities and how they may be addressed in the context of environmental issues.

- Systemic risk describes the risks to the overall economy arising from the risks which the banking system takes. That the private costs of banking failure may be smaller than the social costs justifies banking regulations, although regulations could create a moral hazard.
- Anthropogenic climate change is attributed to greenhouse gas emissions from burning oil, gas, and coal. Global warming has been ranked as the #1 externality of all economic activity, in the magnitude of potential harms and yet remains unmitigated.
- Water pollution by industries that adds poisons to the water, which harm plants, animals, and humans.
- Industrial farm animal production, on the rise in the 20th century, resulted in farms that were easier to run, with fewer and often less-highly-skilled employees,

and a greater output of uniform animal products. However, the externalities with these farms include "contributing to the increase in the pool of antibiotic-resistant bacteria because of the overuse of antibiotics; air quality problems; the contamination of rivers, streams, and coastal waters with concentrated animal waste; animal welfare problems, mainly as a result of the extremely close quarters in which the animals are housed."

- The harvesting by one fishing company in the ocean depletes the stock of available fish for the other companies and overfishing may be the result. This is an example of a common property resource, sometimes referred to as the *Tragedy of the commons*.
- When car owners use roads, they impose congestion costs on all other users.
- A business may purposely underfund one part of their business, such as their pension funds, in order to push the costs onto someone else, creating an externality. Here, the "cost" is that of providing minimum social welfare or retirement income; economists more frequently attribute this problem to the category of moral hazards.
- Consumption by one consumer causes prices to rise and therefore makes other consumers worse off, perhaps by reducing their consumption. These effects are sometimes called "pecuniary externalities". Many economists do not accept the concept of pecuniary externalities, attributing such problems to anti-competitive behavior, monopoly power, or other definitions of market failures.
- The consumption of alcohol by bar-goers in some cases leads to drinking and driving accidents which injure or kill pedestrians and other drivers.
- Commonized costs of declining health and vitality caused by smoking and/or alcohol abuse. Here, the "cost" is that of providing minimum social welfare. Economists more frequently attribute this problem to the category of moral hazards, the prospect that a party insulated from risk may behave differently from the way they would if they were fully exposed to the risk. For example, an individual with insurance against automobile theft may be less vigilant about locking his car, because the negative consequences of automobile theft are (partially) borne by the insurance company.

- The cost of storing nuclear waste from nuclear plants for more than 1,000 years (over 100,000 for some types of nuclear waste) is not included in the cost of the electricity the plant produces. If the nuclear waste is not handled properly it would be a problem for the coming generations, which is the third party in this instance.

In these situations the marginal social benefit of consumption is less than the marginal private benefit of consumption. (i.e. SMB < PMB) This leads to the good or service being over-consumed relative to the social optimum. Without intervention the good or service will be under-priced and the negative externalities will not be taken into account.

**Positive**

Examples of positive externalities (beneficial externality, external benefit, external economy, or Merit goods) include:

- A beekeeper keeps the bees for their honey. A side effect or externality associated with his activity is the pollination of surrounding crops by the bees. The value generated by the pollination may be more important than the value of the harvested honey.
- An individual planting an attractive garden in front of his house may provide benefits to others living in the area, and even financial benefits in the form of increased property values for all property owners.
- An individual buying a product that is interconnected in a network (e.g., a video cellphone) will increase the usefulness of such phones to other people who have a video cellphone. When each new user of a product increases the value of the same product owned by others, the phenomenon is called a network externality or a network effect. Network externalities often have "tipping points" where, suddenly, the product reaches general acceptance and near-universal usage, a phenomenon which can be seen in the near universal take-up of cellphones in some Scandinavian countries.
- Knowledge spillover of inventions and information - once an invention (or most other forms of practical information) is discovered or made more easily accessible, others benefit by exploiting the invention or information. Copyright and intellectual property laws are mechanisms to allow the inventor or creator to

benefit from a temporary, state-protected monopoly in return for "sharing" the information through publication or other means.

- Sometimes the better part of a benefit from a good comes from having the option to buy something rather than actually having to buy it. A private fire department that only charged people that had a fire would arguably provide a positive externality at the expense of an unlucky few. Some form of insurance could be a solution in such cases, as long as people can accurately evaluate the benefit they have from the option.
- A family member buying a movie or game will provide a positive externality to the rest of the family, who can then watch the movie or play the game.
- An organization that purchases a large screen and projector will give benefits to those who may use the screen for various purposes.
- Home ownership creates a positive externality in that homeowners are more likely than renters to become actively involved in the local community. For this reason, in the US interest paid on a home mortgage is an available deduction from the income tax.
- Education creates a positive externality because more educated people are less likely to engage in violent crime, which makes everyone in the community, even people who are not well educated, better off.
- As noted, externalities (or proposed solutions to externalities) may also imply political conflicts, rancorous lawsuits, and the like. This may make the problem of externalities too complex for the concept of Pareto optimality to handle. Similarly, if too many positive externalities fall outside the participants in a transaction, there will be too little incentive on parties to participate in activities that lead to the positive externalities.

**Positional**

Positional externalities refer to a special type of externality that depends on the relative rankings of actors in a situation. Because every actor is attempting to "one up" other actors, the consequences are unintended and economically inefficient.

One example is the phenomenon of "overeducation" (referring to post-secondary education) in the North American labour market. In the 1960s, many young middle-class

North Americans prepared for their careers by completing a bachelor's degree. However, by the 1990s, many people from the same social milieu were completing master's degrees, hoping to "one up" the other competitors in the job market by signalling their higher quality as potential employees. By the 2000s, some jobs which had previously only demanded bachelor's degrees, such as policy analysis posts, were requiring master's degrees. Some economists argue that this increase in educational requirements was above that which was efficient, and that it was a misuse of the societal and personal resources that go into the completion of these master's degrees.

Another example is the buying of jewelry as a gift for another person, e.g. a spouse. For Husband A to show that he values Wife A more than Husband B values Wife B, Husband A must buy more expensive jewelry than Husband B. As in the first example, the cycle continues to get worse, because every actor positions him or herself in relation to the other actors. This is sometimes called keeping up with the Joneses.

One solution to such externalities is regulations imposed by an outside authority. For the first example, the government might pass a law against firms requiring master's degrees unless the job actually required these advanced skills.

***Supply and demand diagram***

The usual economic analysis of externalities can be illustrated using a standard supply and demand diagram if the externality can be monetized and valued in terms of money. An extra supply or demand curve is added, as in the diagrams below. One of the curves is the *private cost* that consumers pay as individuals for additional quantities of the good, which in competitive markets, is the marginal private cost. The other curve is the *true* cost that society as a whole pays for production and consumption of increased production the good, or the marginal social cost.

Similarly there might be two curves for the demand or benefit of the good. The social demand curve would reflect the benefit to society as a whole, while the normal demand curve reflects the benefit to consumers as individuals and is reflected as effective demand in the market.

**External costs**

The graph below shows the effects of a negative externality. For example, the steel industry is assumed to be selling in a competitive market – before pollution-control

laws were imposed and enforced (e.g. under laissez-faire). The marginal private cost is less than the marginal social or public cost by the amount of the external cost, i.e., the cost of air pollution and water pollution. This is represented by the vertical distance between the two supply curves. It is assumed that there are no external benefits, so that social benefit *equals* individual benefit.

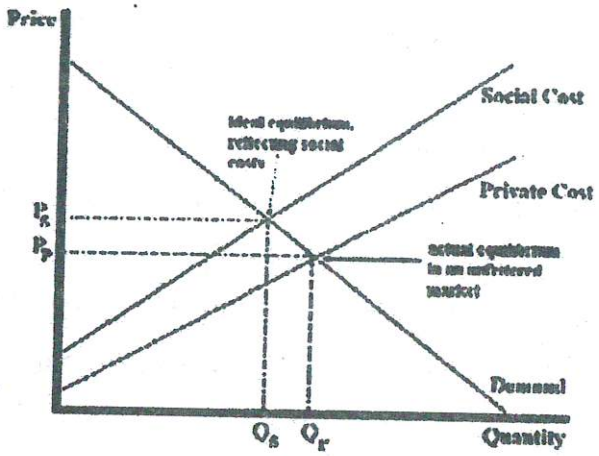


**Figure 4 Supply & Demand with external costs**

If the consumers only take into account their own private cost, they will end up at price $P_p$ and quantity $Q_p$, instead of the more efficient price $P_s$ and quantity $Q_s$. These latter reflect the idea that the marginal social benefit should equal the marginal social cost, that is that production should be increased *only* as long as the marginal social benefit exceeds the marginal social cost. The result is that a free market is *inefficient* since at the quantity $Q_p$, the social benefit is less than the social cost, so society as a whole would be better off if the goods between $Q_p$ and $Q_s$ had not been produced. The problem is that people are buying and consuming *too much* steel.

This discussion implies that negative externalities (such as pollution) are *more than* merely an ethical problem. The problem is one of the disjuncture between marginal private and social costs that is not solved by the free market. It is a problem of societal communication and coordination to balance costs and benefits. This also implies that pollution is not something solved by competitive markets. Some *collective* solution is needed, such as a court system to allow parties affected by the pollution to be compensated, government intervention banning or discouraging pollution, or economic incentives such as green taxes.

**External benefits**

The graph below shows the effects of a positive or beneficial externality. For example, the industry supplying smallpox vaccinations is assumed to be selling in a competitive market. The marginal private benefit of getting the vaccination is less than the marginal social or public benefit by the amount of the external benefit (for example, society as a whole is increasingly protected from smallpox by each vaccination, including those who refuse to participate). This marginal external benefit of getting a smallpox shot is represented by the vertical distance between the two demand curves. Assume there are no external costs, so that social cost *equals* individual cost.

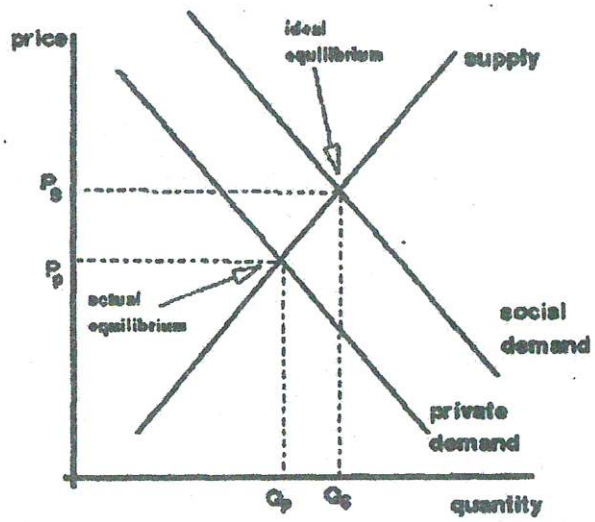


**Figure 5 Supply & Demand with external benefits**

If consumers only take into account their own private benefits from getting vaccinations, the market will end up at price $P_p$ and quantity $Q_p$ as before, instead of the more efficient price $P_s$ and quantity $Q_s$. These latter again reflect the idea that the marginal social benefit should equal the marginal social cost, i.e., that production should be increased as long as the marginal social benefit exceeds the marginal social cost. The result in an unfettered market is *inefficient* since at the quantity $Q_p$, the social benefit is greater than the societal cost, so society as a whole would be better off if more goods had been produced. The problem is that people are buying *too few* vaccinations.

The issue of external benefits is related to that of public goods, which are goods where it is difficult if not impossible to exclude people from benefits. The production of a public good has beneficial externalities for all, or almost all, of the public. As with

external costs, there is a problem here of societal communication and coordination to balance benefits and costs. This also implies that vaccination is not something solved by competitive markets. The government may have to step in with a collective solution, such as subsidizing or legally requiring vaccine use. If the government does this, the good is called a merit good.

## 1.5 EXTERNALITIES AND THE MISSING MARKETS

A missing market is a situation in microeconomics where a competitive market allowing the exchange of a commodity would be Pareto-efficient, but no such market exists.

A classic example of a missing market is the case of an externality like pollution, where decision makers are not responsible for some of the consequences of their actions. When a factory discharges polluted water into a river, that pollution can hurt people who fish in or get their drinking water from the river downstream, but the factory owner may have no incentive to consider those consequences.

Coordination failure can also prevent market formation. Again considering the pollution example, downstream residents might seek to be paid by the factory owner to pollute their water, but because of the free rider problem it may be difficult coordinate.

Another barrier to pollution markets could be technology. If the river has several factories along its banks, it may be difficult or impossible to monitor which factory is responsible for downstream pollution. High transaction costs might also deter market formation. It may be the case that both sides could benefit from an exchange of goods, but that setting up such an exchange is prohibitively expensive.

Markets can also be missing if there is a failure of trust or information. In non zero-sum interactions, it is possible that the Nash Equilibrium for individuals acting independently will be sub-optimal, in that both parties could benefit from cooperating, but on their own will choose not to. An example could be a shortage in footwear, where one person would like to open a factory to make shoes, and the other would like to produce socks, but because they are complementary commodities, neither has incentive to start producing unless he knows that the other will do the same (see also: prisoner's dilemma). The same applies to alternative automotive fuels: few filling station owners

will be interested in offering the fuel until alternate-fuel cars are on the road, but people will not buy alternate-fuel cars until filling stations exist to service them.

In many cases of missing markets, it may be possible for the government or another actor to create circumstances that make market exchange possible. In the case of pollution, one popular solution is for the government to assign property rights in order to allow Coase Bargaining. In cases of information failure, futures markets can help to signal willingness to cooperate. An ownership solution is for one party to integrate into both activities, thereby internalizing the benefits, or to use the surplus generated on one side of the market to subsidize transactions on the other.

## 1.6 THE PROPERTY RIGHTS AND EXTERNALITY

Property rights define who owns what and what the owner can do with what he owns. At the minimum, the owner must be compensated for attenuation of his rights and the owner can transfer his property rights to the highest bidder. Clear ownership rights encourage owner investment to develop his property and transferability ensures that the property ends up in the hands of those who can use it most efficiently. When property rights exist by custom or by default, they cannot be monetized or transferred. Any property rights which cannot be monetized and transferred either because they exist by custom or by default (i.e., *de facto* rights) or because they are governed by *use-it-or-lose-it* clauses would lead to less efficient uses (see Dying for Money and Windfall Profit).

The integrity of property rights depends on enforcement cost. The lower the enforcement cost, the more meaningful are the rights. For example, the invention of barbed wires has been credited with the successful development of cattle ranching in the American West because the wires provided an inexpensive means of enforcing ranch boundaries. The over-exploitation of commons resources is a result of failure to define and enforce property boundaries.

The failure to define the property rights to some resources gives rise to positive and negative externality (in other words, external benefit and external cost). In other words, a transaction can confer benefit or impose cost to third parties without compensation only if the rights to some resources have not been defined. For example,

auto exhaust imposes external cost simply because the right to clean air has not been clearly defined.

Many resources have remained commons because property rights cannot be technically or cheaply defined or enforced. Such difficulties might have explained why these resources have been commonly owned by custom.

If the property rights of clean air can be easily defined and enforced, the parties involved will have an incentive to negotiate a solution to internalize the spillover effects. The resulting pollution will settle on an efficient level provided that the negotiation cost and enforcement cost is negligible.This insight is commonly known as the Coase Theorem after the Nobel Laureate economist Ronald Coase.

Un-internalized externality leads to either under-use or over-use. Specifically, the benefits that flow to unintended parties will not be reflected in private demand. As a result, private demand is lower than otherwise. When these unintended benefits must be paid for, private demand would increase. Given the existing supply, higher private demand would lead to higher price and larger quantity demanded (see External Cost and External Benefit). For example, granting patents to innovative inventions is a way to internalize external benefits for the inventors.

On the other hand, the costs that are imposed on unintended parties will not be taken into account by private supply. As a result, private supply is higher than otherwise. When these costs generated by the private suppliers must be paid for, private supply would decrease. Given the existing demand, lower private supply would lead to higher price and smaller quantity supplied (see External Cost and External Benefit). For example, congestion pricing is a way to internalized external cost generated by drivers with less urgent needs.

## 1.7 NON CONVEXITIES AND EXTERNALITY

The market failure associated with externalities as a problem of incomplete markets. The equivalence between a competitive equilibrium and a Pareto optimum can be restored if markets for external effects can be created. However, employing this framework, where the commodity space is extended to include the rights to generate externalities as additional commodities, the presence of detrimental production

externalities creates fundamental nonconvexities in the technology sets of firms. An example where increases in the level of an externality reduce the maximum output a firm can produce, given the levels of all inputs. But, the maximum output of the firm. for any given level of inputs, is assumed never to fall below zero, even in the face of an unlimited amount of the externality (the firm always has the option of shutting down production). This implies that the frontier of the technology is either asymptotic to the axis reserved for the externality or coincides with it after a critical level of the externality, where the maximum output has fallen to zero, has been reached. As is well known, when the convexity assumption fails, the existence of a competitive equilibrium becomes questionable.

A question then arises about the possibility of existence of some other alternative decentralized mechanism that will, in the presence of externalities, ensure the equivalence between the underlying equilibrium concept and Pareto optimality. A popular candidate is the one associated with Pigovian taxes, attributable to Pigou [1932] and Baumol [1972]. This can be interpreted as a decentralized mechanism where the government is also an economic agent, whose responses (the determination of the Pigovian taxes on the externality generators and the redistribution of tax revenue) depend on the information (the shadow prices) communicated to it by the agents affected by the externalities.

As has been well documented, equilibrium with Pigouvian taxes is compatible with nonconvex technology sets of the firms facing detrimental externalities, so long as the technologies of these firms are convex in the appropriate subspaces. However, the problem with the Pigovian tax mechanism is that, while any Pareto optimum can be decentralized as Pigovian tax equilibrium, the reverse is not true. If the detrimental effects of externalities on victim firms are sufficiently large, the aggregate technology set of the economy could well be nonconvex. In such a nonconvex economy, although the first order conditions of Pareto optimality would hold at a Pigovian tax equilibrium determined by government chosen levels of Pigovian taxes, the second order conditions for even a local Pareto optimum may fail. Thus, an arbitrary Pigovian tax equilibrium may not be efficient, unless, we restrict the class of economies to those where the externalities are weak enough to ensure convexity of the social transformation set, as is done.

The impossibility of the existence of finite-dimensional decentralized mechanisms that guarantee Pareto optimality in the presence of externalities, for all economic environments (including nonconvex ones).

In real economies. BC argues, there are natural limits to the extent to which externalities can be generated. For example, the capacity of land, water, and air to absorb wastes and pollution is really not unlimited. According to them, nonconvexities with externalities are no longer fundamental in a model that treats the externality absorption capacity of the economy as a bounded resource, which has different qualitative values for different agents. Thus, they propose a decentralized mechanism in the spirit of Coase [1960] for convex environments, where the endowment of this capacity is bounded and distributed among agents who trade them. They prove the equivalence between an equilibrium and a Pareto optimum.

## 1.8 PARETO OPTIMAL PROVISIONS FOR PUBLIC GOODS

Public goods provide a very important example of market failure, in which market-like behavior of individual gain-seeking does not produce efficient results. The production of public goods results in positive externalities which are not remunerated. If private organizations don't reap all the benefits of a public good which they have produced, their incentives to produce it voluntarily might be insufficient. Consumers can take advantage of public goods without contributing sufficiently to their creation. This is called the free rider problem, or occasionally, the "easy rider problem" (because consumer's contributions will be small but non-zero).

The free rider problem depends on a conception of the human being as homo economicus: purely rational and also purely selfish -- extremely individualistic, considering only those benefits and costs that directly affect him or her. Public goods give such a person an incentive to be a free rider.

For example, consider national defense, a standard example of a pure public good. Suppose homo economicus thinks about exerting some extra effort to defend the nation. The benefits to the individual of this effort would be very low, since the benefits would be distributed among all of the millions of other people in the country. There is also a

very high possibility that he or she could get injured or killed during the course of his or her military service.

On the other hand, the free rider knows that he or she cannot be excluded from the benefits of national defense, regardless of whether he or she contributes to it. There is also no way that these benefits can be split up and distributed as individual parcels to people. The free rider would not voluntarily exert any extra effort, unless there is some inherent pleasure or material reward for doing so (for example, money paid by the government, as with an all-volunteer army or mercenaries).

In the case of information goods, an inventor of a new product may benefit all of society, but hardly anyone is willing to pay for the invention if they can benefit from it for free.

**Possible solutions**

**Assurance contracts**

An assurance contract, also known as a "provision point mechanism" is a contract in which participants make a binding pledge to contribute to building a public good, contingent on a quorum of a predetermined size being reached. Otherwise the good is not provided and any monetary contributions are refunded.

A dominant assurance contract is a variation in which an entrepreneur creates the contract and refunds the initial pledge plus an additional sum of money if the quorum is not reached. (The entrepreneur profits by collecting a fee if the quorum is reached and the good is provided.) In game-theoretic terms this makes pledging to build the public good a dominant strategy: the best move is to pledge to the contract regardless of the actions of others.

**Coasian solution**

The coasian solution, named for the economist Ronald Coase and unrelated to the Coase theorem, proposes a mechanism by which potential beneficiaries of a public good band together and pool their resources based on their willingness to pay to create the public good. Coase (1960) argued that if the transaction costs between potential beneficiaries of a public good are sufficiently low, and it is therefore easy for beneficiaries to find each other and pool their money based on the public good's value to

them, then an adequate level of public goods production can occur even under competitive free market conditions. However, Coase (1988) famously wrote:

"The world of zero transaction costs has often been described as a Coasian world. Nothing could be further from the truth. It is the world of modern economic theory, one which I was hoping to persuade economists to leave."

The some ways, the formation of governments and government-like communities, such as homeowners associations can be thought of as applied instances of practicing the coasian solution by creating institutions to reduce the transaction costs.

A similar alternative for arranging funders of public goods production, which is especially applicable to information goods, is to produce the good but refuse to release it to the public until some form of payment to cover costs is met. Author Stephen King, for instance, authored chapters of a new novel downloadable for free on his website while stating that he would not release subsequent chapters unless a certain amount of money was raised. Sometimes dubbed holding for ransom, this method of public goods production is a modern application of the street performer protocol for public goods production. Unlike assurance contracts, this relies on social norms to ensure (to some extent) that the threshold is reached and partial contributions are not wasted.

**Government provision**

If voluntary provision of public goods will not work, then the obvious solution is making their provision involuntary. This saves each of us from our own tendency to be a free rider, while also assuring us that no one else will be allowed to free ride. One frequently proposed solution to the problem is for governments or states to impose taxation to fund the production of public goods. This does not actually solve the theoretical problem because good government is itself a public good. Thus it is difficult to ensure the government has an incentive to provide the optimum amount even if it were possible for the government to determine precisely what amount would be optimum. These issues are studied by public choice theory and public finance.

Sometimes the government provides public goods using "unfunded mandates". An example is the requirement that every car be fit with a catalytic converter. This may be executed in the private sector, but the end result is predetermined by the state: the individually involuntary provision of the public good clean air. Unfunded mandates have

also been imposed by the U.S. federal government on the state and local governments, as with the Americans with Disabilities Act, for example.

**Subsidies and joint products**

A government may subsidize production of a public good in the private sector. Unlike government provision, subsidies may result in some form of a competitive market. The potential for cronyism (for example, an alliance between political insiders and the businesses receiving subsidies) can be limited with secret bidding for the subsidies or application of the subsidies following clear general principles. Depending on the nature of a public good and a related subsidy, principal agent problems can arise between the citizens and the government or between the government and the subsidized producers; this effect and counter-measures taken to address it can diminish the benefits of the subsidy.

Subsidies can also be used in areas with a potential for non-individualism: For instance, a state may subsidize devices to reduce air pollution and appeal to citizens to cover the remaining costs.

Similarly, a joint-product model analyzes the collaborative effect of joining a private good to a public good. For example, a tax deduction (private good) can be tied to a donation to a charity (public good). It can be shown that the provision of the public good increases when tied to the private good, as long as the private good is provided by a monopoly (otherwise the private good would be provided by competitors without the link to the public good).

**Privileged group**

The study of collective action shows that public goods are still produced when one individual benefits more from the public good than it costs him to produce it; examples include benefits from individual use, intrinsic motivation to produce, and business models based on selling complement goods. A group that contains such individuals is called a privileged group. A historical example could be a downtown entrepreneur who erects a street light in front of his shop to attract customers; even though there are positive external benefits to neighboring nonpaying businesses, the added customers to the paying shop provide enough revenue to cover the costs of the street light.

The existence of privileged groups is not a complete solution to the free rider problem, however, as underproduction of the public good can still result. The street light builder, for instance, would not consider the added benefit to neighboring businesses when determining whether to erect his street light, making it possible that the street light isn't built when the cost of building is too high for the single entrepreneur even when the total benefit to all the businesses combined exceeds the cost.

An example of the privileged group solution could be the Linux community, assuming that users derive more benefit from contributing than it costs them to do it. For more discussion on this topic see also Coase's Penguin.

**Merging free riders**

Another method of overcoming the free rider problem is to simply eliminate the profit incentive for free riding by buying out all the potential free riders. A property developer that owned an entire city street, for instance, would not need to worry about free riders when erecting street lights since he owns every business that could benefit from the street light without paying. Implicitly, then, the property developer would erect street lights until the marginal social benefit met the marginal social cost. In this case, they are equivalent to the private marginal benefits and costs.

While the purchase of all potential free riders may solve the problem of underproduction due to free riders in smaller markets, it may simultaneously introduce the problem of underproduction due to monopoly. Additionally, some markets are simply too large to make a buyout of all beneficiaries feasible - this is particularly visible with public goods that affect everyone in a country.

**Introducing an exclusion mechanism (club goods)**

Another solution, which has evolved for information goods, is to introduce exclusion mechanisms which turn public goods into club goods. One well-known example is copyright and patent laws. These laws, which in the 20th century came to be called intellectual property laws, attempt to remove the natural non-excludability by prohibiting reproduction of the good. Although they can address the free rider problem, the downside of these laws is that they imply private monopoly power and thus are not Pareto-optimal.

For example, in the United States, the patent rights given to pharmaceutical companies encourage them to charge high prices (above marginal cost) and to advertise to convince patients to nag their doctors to prescribe the drugs. Likewise, copyright provides an incentive for a publisher to act like The Dog in the Manger, taking older works out of print so as not to cannibalize revenue from the publisher's own new works.[7] The laws also end up encouraging patent and copyright owners to sue even mild imitators in court and to lobby for the extension of the term of the exclusive rights in a form of rent seeking.

These problems with the club-good mechanism arise because the underlying marginal cost of giving the good to more people is low or zero, but, because of the limits of price discrimination those who are unwilling or unable to pay a profit-maximizing price do not gain access to the good.

If the costs of the exclusion mechanism are not higher than the gain from the collaboration, club goods can emerge naturally. James M. Buchanan showed in his seminal paper that clubs can be an efficient alternative to government interventions.

On the other hand, because of the inherent inefficiency of club good provision, it is sometimes preferable to treat even naturally excludable club goods as public goods, and produce them by some other mechanism. Examples of such "natural" club goods include natural monopolies with very high fixed costs, private golf courses, cinemas, cable television and social clubs. This explains why many such goods are often provided or subsidized by governments, co-operatives or volunteer associations, rather than being left to be supplied by profit-minded entrepreneurs. These goods are often known as social goods.

Joseph Schumpeter claimed that the "excess profits," or profits over normal profit, generated by the copyright or patent monopoly will attract competitors that will make technological innovations and thereby end the monopoly. This is a continual process referred to as "Schumpeterian creative destruction", and its applicability to different types of public goods is a source of some controversy. The supporters of the theory point to the case of Microsoft, for example, which has been increasing its prices (or lowering its products' quality), predicting that these practices will make increased market shares for Linux and Apple largely inevitable. A nation can be seen as a club whose members are its

citizens. Government would then be the manager of this club. This is further studied in the Theory of the State.

**Social norms**

If enough people do not think like free-riders, the private and voluntary provision of public goods may be successful. A free rider might litter in a public park, but a more public-spirited individual would not do so, getting an inherent pleasure from helping the community. In fact, one might voluntarily pick up some of the existing litter. If enough people do so, the role of the state in using taxes to hire professional maintenance crews is reduced. This might imply that even someone typically inclined to free-riding would not litter, since their action would have such a cost.

Public mindedness may be encouraged by non-market solutions to the economic problem, such as tradition and social norms. For example, concepts such as nationalism and patriotism have been part of most successful war efforts, complementing the roles of taxation and conscription. To some extent, public spiritedness of a more limited type is the basis for voluntary contributions that support public radio and television. Contributions to online collaborative media like Wikipedia and many other projects utilising wiki technology can also be seen to represent an example of such public spiritedness, since they provide a public good (information) freely to all readers.

Groups relying on such social norms often have a federated structure, since collaboration emerges more readily in smaller social groups than in large ones (e.g. see Dunbar's number). This explains why labor unions or charities are often organized this way

**In fact there are at least four general types of solutions to the problem of externalities:**

- Criminalization: As with prostitution, addictive drugs, commercial fraud, and many types of environmental and public health laws.
- Civil Tort law: For example, class action by smokers, various product liability suits.
- Government provision: As with lighthouses, education, and national defense.
- Pigovian taxes or subsidies intended to redress economic injustices or imbalances.

A Pigovian tax is a tax imposed that is equal in value to the negative externality. The result is that the market outcome would be reduced to the efficient amount. A side effect is that revenue is raised for the government, reducing the amount of distortionary taxes that the government must impose elsewhere. Economists prefer Pigovian taxes and subsidies as being the least intrusive and most efficient method to resolve externalities.

However, the most common type of solution is tacit agreement through the political process. Governments are elected to represent citizens and to strike political compromises between various interests. Normally governments pass laws and regulations to address pollution and other types of environmental harm. These laws and regulations can take the form of "command and control" regulation (such as setting standards, targets, or process requirements), or environmental pricing reform (such as ecotaxes or other pigovian taxes, tradable pollution permits or the creation of markets for ecological services). The second type of resolution is a purely private agreement between the parties involved.

Government intervention may not always be needed. Traditional ways of life may have evolved as ways to deal with external costs and benefits. Alternatively, democratically-run communities can agree to deal with these costs and benefits in an amicable way. Externalities can sometimes be resolved by agreement between the parties involved. This resolution may even come about because of the threat of government action.

Ronald Coase argued that if all parties involved can easily organize payments so as to pay each other for their actions, then an efficient outcome can be reached without government intervention. Some take this argument further, and make the political claim that government should restrict its role to facilitating bargaining among the affected groups or individuals and to enforcing any contracts that result. This result, often known as the Coase Theorem, requires that

- Property rights be well defined
- People act rationally
- Transaction costs be minimal

If all of these conditions apply, the private parties can bargain to solve the problem of externalities.

This theorem would not apply to the steel industry case discussed above. For example, with a steel factory that trespasses on the lungs of a large number of individuals with pollution, it is difficult if not impossible for any one person to negotiate with the producer, and there are large transaction costs. Hence the most common approach may be to regulate the firm (by imposing limits on the amount of pollution considered "acceptable") while paying for the regulation and enforcement with taxes. The case of the vaccinations would also not satisfy the requirements of the Coase Theorem. Since the potential external beneficiaries of vaccination are the people themselves, the people would have to self-organize to pay each other to be vaccinated. But such an organization that involves the entire populace would be indistinguishable from government action.

In some cases, the Coase theorem is relevant. For example, if a logger is planning to clear-cut a forest in a way that has a negative impact on a nearby resort, the resort-owner and the logger could, in theory, get together to agree to a deal. For example, the resort-owner could pay the logger not to clear-cut – or could buy the forest. The most problematic situation, from Coase's perspective, occurs when the forest literally does not belong to anyone; the question of "who" owns the forest is not important, as any specific owner will have an interest in coming to an agreement with the resort owner (if such an agreement is mutually beneficial).

**Activity 1**

1. What do you understand by concepts of Pareto optimality and competitive equilibrium? Discuss Pareto optimality in context of economics.
2. Discuss briefly two fundamental theorems of welfare economics.
3. How property rights can be protected in case of negative externalities.
4. Explain how the problems caused by externalities can be solved using possible solutions. Give suitable examples.

## 1.9 SUMMARY

The most widely-used concept in theoretical welfare economics is "Pareto optimality" (also known as "Pareto efficiency"). An allocation is Pareto-optimal iff it is impossible to make at least one person better off without making anyone else worse off. Similarly amongst two fundamental theorems of welfare economics, the first states that

any competitive equilibrium or leads to a Pareto efficient allocation of resources. The second states the converse, that any efficient allocation can be sustainable by a competitive equilibrium. Later in the chapter the externalities which are perceived to be the impact on a party that is not directly involved in the transaction, are explained along with the relevance of these externalities in cases of market inefficiency, missing markets, non convexities and property rights. Finally the Pareto optimal provisions for public goods have discussed followed by some recommended solutions to deal the problems caused by negative externalities.

## 1.10 FURTHER READINGS


- Pigou, A.C. (1920). *Economics of Welfare*. Macmillan and Co.
- Baumol, W.J. (1972), 'On Taxation and the Control of Externalities', *American Economic Review*, *62*(3), 307-322.
- Tullock, G. (2005). *Public Goods, Redistribution and Rent Seeking*. Edward Elgar Publishing, Inc..

# UNIT 2

# MEASUREMENT OF ENVIRONMENTAL VALUES

**Objectives**

After studying this unit, you should be able to understand:

- Concepts and theory of environment valuation and total economic values.
- The relevance of different types of economic values
- Different techniques of environment valuation.

**Structure**

2.1 Introduction

2.2 The theory of environmental valuation and the total economic value

2.3 Environment valuation techniques

2.4 Summary

2.5 Further readings

## 2.1 INTRODUCTION

Valuation is the heart of environmental economics; it is a very active and rapidly expanding field. The basic strategy for environmental valuation is the 'co - modification' of the services that the natural environment provides. It serves to assess individual and group priorities and tradeoffs in the case of unpriced scarce commodities. It has been used to assess the desirability of specific Government investments in environmental improvement and to assess the desirability of new regulations to protect certain aspects of the environment from further degradation. It has also been used to rank the seriousness of environmental problems in order to provide guidance to environmental agencies as they decide on how to focus their efforts.

In its simplest form economic valuation is the process of identifying the relevant changes in consumer demand and producer supply arising from a (project induced) change in environmental quality, or the change in the provision of an environmental resource. In brief Environmental Valuation is concerned with the analysis of methods for obtaining empirical estimates of environmental values, such as the benefits of improved river water quality, or the cost of losing an area of wilderness to development.

## 1.2 THE THEORY OF ENVIRONMENTAL VALUATION AND THE TOTAL ECONOMIC VALUE (TEV)

For some goods and services (e.g. a net or a boat purchased by a capture fishery operator), the market provides prices that reasonably reflect the value society places on that good or service. For other goods and services however, market prices either only partially reflect the value society places on them (e.g. electricity) or do not exist at all (e.g. the use of a Lake or the atmosphere as a discharge sink). To simplify the task of valuation, therefore, economists like to disaggregate project impacts on the environment into individual components of value.

The most commonly used approach is based on the concept of Total Economic Value (TEV).

Under the Total Economic Value (TEV) approach an impact on an environmental resource, for example, a waterborne pollutant on a river, is broken down into a number of categories of value. The logic behind the approach is that a good or service comprises of various attributes, some of which are tangible and readily measured, while others are less tangible and thus more difficult to quantify. The total value of the good or service however, is given by the sum of all categories of value, and not simply those that are easy to measure.

The Total Economic Value is generally decomposed into three categories of value: (1) direct use value; (2) indirect use value; and (3) nonuse value. The former two categories are sometimes collectively referred to as "use value". Further subdivision of these categories is also possible as shown in the figure.

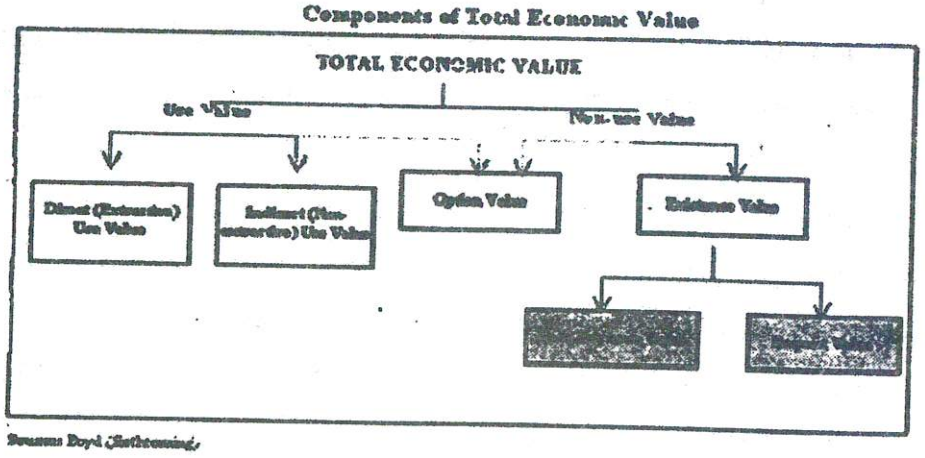


Figure 6

**Direct use value**

The Direct use value is derived from goods, which can be extracted, consumed or directly enjoyed. It is also therefore known as extractive or consumptive use value. In the context of a river, for example, Direct (extractive) use value is derived from the harvesting of fish.

**Indirect use value**

Indirect use value is referred to as non-extractive use value, derived from the services that an environmental resource provides. A wetland, for example, acts as a water filter, often improving water quality for downstream users. This service is valued by downstream users, but does not require any good to be extracted / consumed. In terms of measurement, indirect use values differ from direct use values in two ways: (1) the 'quantity' of the service provided is often hard to define and (2) the types of services in question are often not traded in established markets, and therefore have no readily observable 'prices'. For these reasons, measuring indirect use value is relatively more difficult than measuring direct use value.

**Non-use values**

Non-use values are defined as those benefits or welfare gains/losses to individuals that arise from environmental changes independently of any direct or indirect use of the environment. This category can be further subdivided into (1) option value and (2) existence value.

The former is a benefit expressed through an option to use the environment - that is, the value of the environment as a potential benefit as opposed to an actual present use benefit. If you are unsure whether you will use an environmental service or not, you might be willing to pay a positive sum to guarantee that the service will still be available in case you desire to use it at a later date. Option values consequently arise when you are uncertain about whether you will demand a commodity in some future time period and are faced with uncertainty concerning the future supply or availability of that commodity. It is distinct from a use value in that it arises not from the use of the site itself but from uncertainty over the site's availability to meet future demands. In this way option value is akin to an insurance policy against future uncertainty.

As option value is the value derived from maintaining the option to use a good or service at some point in the future, it is sometimes treated as a special case of use value (hence the dashed line in (figure) Existence value can be defined in various ways. Most definitions however contain two main components: (1) pure existence values and (2) bequest values.

A pure existence value relates to the worth you associate with an environmental good or service, which is completely unrelated to current or future use of that commodity, by yourself, your descendants, or others. These values are intrinsic in nature, i.e. they represent a value that resides in something. Some possible motivations or rationales for the presence of such values include the preservation of, concern for, sympathy with, respect for the rights of, any other altruistic motives with respect to non-human beings. A number of pure existence values are related to ecological attributes. Support for the protection of endangered species and the protection of critical habitats for those species represents an intrinsic valuation process.

Bequest value derive from our desire to preserve the environment for relatives and friends, and also for all other people living today and future generations, so that they may benefit from conservation of the environment. Since in most cases non-use value is not, by definition, reflected in individual's behaviour and is thus not observable, it is the most difficult component of TEV to measure.

**Total Economic Value = Direct and Indirect Use Values + Option Values + Existence Values**

It is of crucial importance to assess the change in the TEV arising from a project-induced change in environmental quality, or a change in the provision of an environmental resource. It will often be the case that the 'true' benefits (change in TEV) of a proposed project or policy will be much greater than its direct use value, but the direct use value may be less than the cost of the resource inputs.

## 1.3 ENVIRONMENTAL VALUATION TECHNIQUES

Environmental valuation techniques can be broadly classified into two sets. The first set is based on technical (physical) linkages that formally describe cause and effect relationships. Included in this set of techniques are the change in the output (or input) of

marketable goods, the cost of illness and the replacement cost methods. The second set of techniques is based on behavioural linkages between a change in the state of the environment and the actions of individuals, whereby values are either stated or revealed in actual or hypothetical market behaviour. Using revealed behaviour, we examine the trade-offs individuals make between the state of the environment and goods or service traded in actual markets. These so-called revealed preference approaches include the hedonic property, wage-risk, travel cost and averting expenditures approaches. When environmental goods or services cannot be valued, even indirectly using revealed preference approaches, we can ask individuals directly to express how much they are WTP for a certain level of that environmental good or service. Contingent valuation and constructed markets are the two main types of so-called stated preference techniques. Another approach to benefit valuation in CBA is benefit transfer, although strictly speaking not a valuation method.

### 1.3.1 Hedonic Price Method

It is based on consumer theory, which postulates that every good provides a bundle of characteristics or attributes. Market goods are often regarded as intermediate inputs into production of more basic attributes that the individuals really demand. For example the demand for housing can be considered a derived demand. A house yields shelter but through its location it also yields access to different quantities and qualities of public services (example: schools, cultural activities etc.) and different quantities and qualities of environmental goods (open space, woodland etc.). Thus HPM relies on the proposition that an individual's utility for a good or service is based on the attributes, which it possesses. If the hedonic analysis is conducted on housing data, it is referred to as the property value approach. When applied to wage data – to measure the value of changes in morbidity/mortality risks – it is often referred to as the wage differential or wage-risk approach.

The hedonic property value approach measures the welfare effects of changes in environmental goods or services by estimating the influence of environmental attributes on the value (or price) of properties. In order to obtain a measure of how a specific environmental attribute of interest affects the welfare of individuals, the technique attempts to: (1) identify how much of a property price differential is due to a particular

environmental difference between properties and (2) infer how much people are willing-to-pay for an improvement in the environmental quality and to estimate the social value of improvements.

In attempting to isolate the effects of specific environmental attributes on the price of houses we have to "explain" the price of a house as a function of its key characteristics. If we take house price to be a function of all the physical features of the house (e.g. number of rooms, central heating, garage space etc.), neighbourhood characteristics, and environmental attributes, then the following relationship can be identified:

$$P^h = f(S, N, E)$$

where

$P^h$= The market price of the property.

f = The function that relates the house characteristics to price.

S = The different structural characteristics of the property.

N = The different neighbourhood characteristics of the property.

E = The different environmental attributes of the property.

This function is called a hedonic price function. Fixing the level of all the structural characteristics of a property and the neighbourhood characteristics, we are able to focus on the relationship between the property price and the environmental attribute under investigation. By partially differentiating the hedonic price function with respect to E we obtain the implicit price (or implicit price curve) of the environmental attribute This partial derivative is interpreted as the price paid by the individuals for the last unit of the environmental attribute, purchased by choosing a given property instead of another one with a unit less of the environmental attribute, other things being equal. Estimated implicit prices for different properties refer to different individuals. Every estimated implicit price is only one observation of the true individual demand curve and corresponds to the individual WTP for a marginal unit of environmental good only for that specific level of environmental good purchased. Therefore, the implicit price (curve) cannot be viewed as an inverse demand curve. Hence, it does not represent the maximum marginal WTP of the individual for one more unit of the environmental attribute, unless we assume that all the individuals have the same structure of preferences and the same

income. If this assumption does not hold, the various individuals will have different inverse demand curves. Nevertheless the implicit price can be regressed on the observed quantities of the environmental attribute and some socio-economic characteristics of individuals. This "second stage" regression could allow the identification of the inverse individual demand function. The area under the inverse demand curve between two levels of the environmental attribute represents the change in the consumer surplus caused by the change in this attribute. By aggregating all individuals' consumer surpluses we obtain the overall value of the environmental change.

In practice, especially in developing countries, only the first stage of the process is usually carried out, and the results used to obtain only rough values for the impact of the attribute in question. A summary of the main steps followed in undertaking a hedonic property value study is outlined in Figure below.

**Table: Step-by-Step Procedure for the Calculation of the Consumer Surplus with the Hedonic Property Value Approach**

| Steps | ← | Assumptions-Notes |
|---|---|---|
| Collection of data on proces and houses features | ← | Various methods exist to collect these data. For complex studies this data must be complemented with information on the socio-economic characteristics of households investigated |
| Estimation of the hedonic price function | ← | This relates the price of houses to the characteristics explaining the house price. |
| Calculation of the implicit price of the environmental attribute in question | ← | This is the first derivative of the house price function with respect to the environmental attribute |
| Estimation of the inverse demand curve of the environmental attribute | ← | The price paid is explained by the quantity/quality of the environmental attribute but also by the socio-economic characteristics of households |
| Calculation of the consumer surplus | ← | Integration of the implicit demand curve between the former level of environmental quality/quantity and the new one. |

**Source:** Markandya *et al* (forthcoming)

The hedonic wage-risk method is very similar, and is only briefly discussed here. Basically, to estimate the relationship between wages and risks we must control for other variables that influence earnings - as in the hedonic property value approach above - except this time we estimate a hedonic wage function:

$$W = f(Q, X, R)$$

where

| | |
|---|---|
| $W$ | Wage rate in each occupation. |
| $Q$ | Qualifications of workers. |
| $X$ | Job attributes such as unionisation, desirability, etc. |
| $R$ | Workplace risk, e.g. risk of death. |

The partial derivative of this function with respect to R is the wage premium for accepting, say, an additional risk of death of 1 in 10,000. To estimate a 'value of a statistical life' (VOSL) from this, the wage premium is factored by the additional risk (in this case 10,000). For example, if the 'average' wage premium is $45 in this case, then the VOSL is given by

$$\uparrow \frac{1}{100{,}000} \times 100{,}000 = 1 \Rightarrow \$45 \times 100{,}000 = \$4{,}500{,}000$$

The hedonic technique has several advantages. Firstly, hedonic analysis uses market, i.e. observed, data on property sales or wage rates. The method is versatile and can be adapted to consider several possible interactions between market goods and environmental quality. Moreover, estimated values obtained from one study can be used in other policy areas if the environments have similar demand and supply characteristics. On the negative side, the results of hedonic studies are sensitive to the econometric assumptions adopted. Furthermore, the assumptions necessary to interpret the results as measures of WTP are restrictive and, in many real world settings, unrealistic. From a

practical perspective. full hedonic pricing studies require a considerable amount of data, which may be difficult and expensive to collect, such studies tend not to be done quickly.

### 1.3.2 The Travel Cost Method

The Travel Cost (TC) method is an example of a technique, which attempts to deduce values from observed (i.e. revealed) behaviour. The TC model and its many variants is the most commonly used indirect approach to valuing site-specific levels of environmental resource provision. Basically, information on visitors' total expenditure to visit a site is used to derive their demand curve for the services provided by the site. Among other things, the TC model assumes that changes in total travel expenditures are equivalent to changes in an admission fee Given this, the model is used to predict changes in demand in response to changes in 'admission fees', thereby tracing out a demand curve for the site. This demand curve may then be used to measure the total benefits visitors accrue from the site.

There are two main variants of the TC model: (1) the Zonal TC model (ZTCM) and (2) the Individual TC model (ITCM). The ZTCM divides the entire area from which visitors originate into a set of visitor zones and then defines the dependent variable as the visitor or visitation rate (i.e. the number of visits made from a particular zone in a period divided by the population of that zone). The ITCM defines the dependent variable as the number of site visits made by each visitor over a specified period.

The basic (zonal) travel cost model defines a trip demand curve for a given recreational site from zone as

$$\frac{V_j}{P_j} = f(TC_j, .X_j)$$

$V_j$ = The total number of trips by individuals from zone $j$ to the recreational site per unit of time,

$f$ = The function that relates travel cost and socio-economic characteristics to visitation rates,

$P_j$ = The population of zone $j$,

$TC_j$ = The travel cost from zone $j$ to the recreational site and

$X_j$ = The socio-economic characteristics of the population of zone $j$, which include, amongst others, factors such as income levels, spending on other goods, the existence of substitute sites, entrance fees and quality indices of n substitute sites

The visitor or visitation rate $V_j/P_j$ is generally calculated as visits per unit of population, usually expressed in thousand persons, in zone.

Based on data obtained from a survey of site users, the above equation is estimated using regression analysis. This leads to the creation of a so-called 'whole experience' demand curve based on visitation rates and not the number of actual visits made. To estimate the consumer surplus accruing from the site, the 'whole experience' demand curve is used to estimate the actual number of visitors and how the numbers would change subject to increases in admissions 'prices' – in essence constructing a classic inverse demand curve.

The base data set, from which the 'whole experience' demand curve is created, defines one point on the inverse demand curve for the study site – that is, the intersection of the present zero price line and the inverse demand curve ( $V_o$). In Fig this is given by point A, where admission fees or added trip cost is zero.

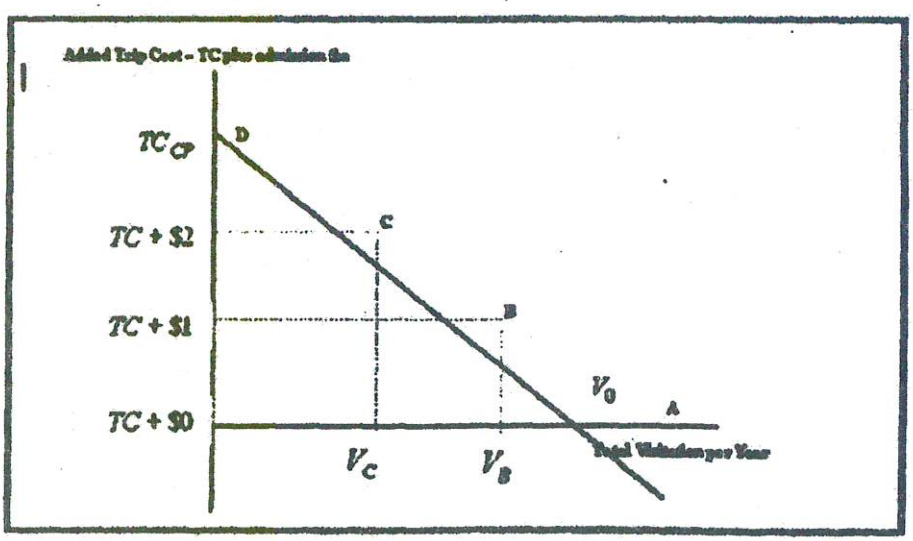


**Figure7 zonal travel cost**

As mentioned above, the remainder of is derived by assuming that visitors will respond to increases in admission fees in the same way they would to equal increases in travel cost. For each incremental increase in admission fees, the expected visitation rate from each travel origin zone is calculated using the above equation. The 'new' zone-specific visitation rates are then converted to expected numbers of visitors using data on . These values are summed across all travel origin zones to find the predicted total number of visitors to the site at the added trip cost (i.e. original travel cost plus, say, $1). For example, a $1 increase in trip costs may lead to point B in Fig a $2 increase in trip costs may lead to point C, etc. This process is repeated until the added trip cost is sufficient to result in zero visitors to the site (the so-called choke price given by point D in Fig) – until the entire inverse demand curve ($V_O$) is traced.

The area under $V_O$ provides an estimate of the total consumer surplus enjoyed by present users of the study site.

The basic (individual) travel cost model relates individual's annual visits to the costs of those visits – that is (Markandya et al, forthcoming),

$$V_i = f(TC_i, X_i)$$

where Vi = The number of visits made in a time period, say a year, by individual i to the site. TCi= Travel cost faced by individual i to visit the site. Xi= All other factors determining individual i's visits (income, time, and other socio-economic characteristics).

This demand function can be extended to allow for the specification of a number of explanatory variables. These include the individual's estimate of the proportion of the enjoyment of the overall trip imputed to the specific site under investigation, the individual's view of the availability of substitute sites, size of individual's household and whether the individual is a member of an environmental organization, as well as other socio-economic data. Integrating the demand curve between the actual travel cost TCi and the choke price gives an estimate of the individual annual consumer surplus (ICS) for individuals.

The total annual consumer surplus for the site is obtained by multiplying the ICS by the number of individuals visiting the site annually. The modelling of individual socio-economic features enables the estimation of consumer surplus for different socio-economic groups of visitors. Alternatively, the average ICS per visit can be calculated and then multiplied by the total annual number of visits to the site to get the total annual consumer surplus of the site.

Like hedonic techniques, the TC method has the advantage that it is based on observed behaviour. Also, TC is a well-tried technique, which is generally accepted, yields plausible results. The individual TC model, the zonal TC model, or similar specifications, have been used to assess changes in site quality. which include the degradation of water quality, changes in fish catches, etc. However, they are more commonly used to value the total benefit of a resource, rather than changes in that resource. The TC method is not without its disadvantages however. To start, in complex situations, especially when changes in environmental quality are being assessed, the data requirements are considerable. Moreover, "a whole host of issues arises in the specification and estimation of the model and subsequent calculation of consumer surplus, all of which have enormous bearing on the final benefit estimates". These issues include the development of multi-site models, the valuation of travel time and the treatment of non-visitors. As a result, TC studies tend to be conducted as self-standing research studies, with sufficient resources to adequately address these complex issues.

The main application of TC in developing countries is to value tourist's WTP for national parks. For example, in Zimbabwe, a TC study of tourists found that they derived a benefit (consumer surplus) of about US$ 275 per person per trip to national parks. In Costa Rica, a TC valued trips to parks and reserves at US$ 1,150 per person.

**Random utility models**

Random utility models (RUMs) are econometric models that, among other uses, permit the estimation of preferences among different recreational areas with varying characteristics. The RUM, with its ability to assess competing multiple sites with varying recreational characteristics, holds considerable appeal for economists. Consider three

beaches with characteristics that vary based on location, water quality, landscape features, access, existence of lavatories, and other services. These characteristics can be transformed into discrete and continuous variables used to assess consumer preference by examining location preference and the total cost of trips taken (Table 4). Based on the data collected through surveys of various sites, the RUM estimates the probability that an individual will visit one site out of several sites based on site characteristics. Varying the quality of those characteristics (e.g., water quality, landscape features) permits the ana' 'st to assess how recreational travelers value changes in environmental quality at particular sites. A RUM is not specific to surrogate market techniques. Rather, a RUM is an estimation procedure that can be combined with surrogate and non-market techniques used in valuing, for example, recreational areas and wetland area restoration. Travel cost studies often use RUMs; however, they may also be applied in stated preference studies that use choice experiments.

**Table . Expenditures per Trip and Number of Trips Taken (Adapted from Lipton 1995)**

| Individual | Travel Costs / Number of Trips | Site I | Site II | Site III |
|---|---|---|---|---|
| 1 | Travel Costs | $20 | $40 | $50 |
| | Number of Trips | 4 | 3 | 2 |
| 2 | Travel Costs | $52 | $26 | $15 |
| | Number of Trips | 1 | 4 | 2 |
| 3 | Travel Costs | $30 | $30 | $45 |
| | Number of Trips | 3 | 6 | 1 |

### 1.3.3 Contingent Valuation Method (CVM)

This method uses interview techniques to ask individuals to place values on environmental goods and services. The most common approach in the CVM is to ask individuals the maximum amount of money they are willing to pay (WTP) to use or preserve a good or service. Alternatively the respondents could be asked the maximum amount of money they are willing to accept in compensation (WTA) to forgo the given environmental good or service. The basic notion underpinning CV is that a realistic, yet hypothetical market for buying or selling use and/or preservation of an environmental good/service can be described in detail to an individual. Individuals are then asked to participate in this hypothetical market, by responding to a series of questions.

**The main features of the hypothetical market include:**

- A detailed description of the good/service being valued. The situation before and after any proposed change in environmental quality and subsequent provision of the good/service should be clearly stated. In addition, it is vital that the respondents perceive the correct good/service.

- A detailed description of the "payment vehicle", i.e. the means by which the respondent would pay for the change in provision of the good/service. The payment vehicle should be appropriate to the good/service and the hypothetical market. Moreover, it should be realistic and emotionally neutral.

- The procedure to elicit the respondent's valuation. The actual valuation can be obtained in a number of ways, for example, asking the respondent to name an amount, having them choose from a number of options. The respondent could also be asked whether they would pay a specific amount. In the case of the latter, follow-up questions with higher and lower amounts are often used. Statistical analysis of the responses is then undertaken to estimate the average WTP in this hypothetical market.

A general approach to follow when running a CV study is outlined in figure. The nature of CV means that, in principle, it can be used to value any change in environmental quality. Furthermore, CV can be used to accurately elicit values about very specific changes in the provision of goods/services, since it does not rely on observed data. Of course, this requires that the hypothetical market and elicitation questions be appropriately worded. An additional plus for CV is that, in contrast to the other valuation techniques described above, which only provide a partial estimate of the value of a good/service, CV can provide a measure of the TEV of a change in environmental quality. CV methods have nonetheless been the subject of much criticism, mainly relating to their reliance on hypothetical markets (.In short, some economists argue that asking individuals hypothetical questions only provides you with hypothetical answers, which cannot be meaningfully used to value environmental quality changes. Following controversy of the use of CV to value damages from the 1989 Exxon Valdez oil spill, the US Department of Interior and the National Oceanic and Atmospheric Administration organized a "Blue Ribbon" panel to assess the validity of using CV to value environmental damage. The panel concluded that that CV could provide useful and reliable information for this type of assessment, as long as certain guidelines are followed. In general, the profession as a whole has also given CV qualified acceptance.

In addition to the above conceptual concerns over the validity of CV based benefits estimates, survey-based research is expensive and time-consuming, valid benefit estimates require properly designed sampling and enumeration procedures.

The key steps in conducting Contingent Valuation are as shown.

| STEP 1 of the Objectives | → | STEP 2 Questionnaire Design | → | STEP 3 Survey of Sampled Population | → | STEP 4 Database Creation and Data Analysis | → | STEP 5 WTP Estimation |
|---|---|---|---|---|---|---|---|---|
| ↓ | | ↓ | | ↓ | | ↓ | | ↓ |
| 1a Identification of the object to be valued | | 2a Introduction | | 3a Decide the sampling technique | | 4a Collection and verification of data | | 5a WTP models choice |
| 1b Establishment of value to be estimated and unit of measurement | | 2b Socio-economic information | | 3b Decide how, when, and where to run interviews | | 4b Data base creation | | 5b Estimation of annual individual average max WTP |
| 1c Identification of time span of the valuation | | 2c Scenario formulation | | 3c Training of enumerators | | 4c Elimination of invalid questionnaires | | 5c Annual net benefits |
| 1d Identification of who should be interviewed (definition of the population) | | 2d WTP/WTA elicitation format | | 3d Running the interviews | | 4d Derived variables building | | 5d Total value of environmental services |
| | | 2e Payment vehicle | | | | 4e Data analysis | | |

**Activity 2**

1. Discuss the concept of environmental values.
2. Explain various methods of environment valuation with special reference to direct and indirect methods.
3. Write short notes on the following:

- use values
- non use values
- optional values
- The travel cost method

## 1.4 SUMMARY

The objective of environmental valuation techniques is to reveal individuals' preferences by making use of a real or hypothetical environmental market. Some valuation techniques are direct and question individuals using surveys. These methods include the Contingent Valuation Method or the use of auctions. Other techniques are more indirect, that is they use other preference revelation methods, for instance the price of goods in a market that has links to environmental amenities. An example of this is the Travel Cost Method which uses the amount people are willing to pay, transport wise, to have access to a heritage site or a natural reserve. Similarly method of hedonic prices has been discussed as based on consumer theory, which postulates that every good provides a bundle of characteristics or attributes.

## 1.5 FURTHER READINGS


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# UNIT 3

# ENVIRONMENTAL POLICY AND REGULATIONS

**Objectives**

After completing this unit, you should be able to:

- Understand the utility and relevance of environmental policy and regulations.
- Know the basic instruments of environmental policy based on different assumptions
- Become aware of the effort of governments in enforcement and monitoring of environmental regulation.
- Determine the WTO regime and its approaches toward international trade and environment protection.

**Structure**

3.1 Introduction

3.2 The environmental policy instruments

3.3 Government monitoring and enforcement of environmental regulation

3.4 International trade and environment in WTO regime

3.5 Summary

3.6 Further readings

## 3.1 INTRODUCTION

Environmental policy is any [course of] action deliberately taken [or not taken] to manage human activities with a view to prevent, reduce, or mitigate harmful effects on nature and natural resources, and ensuring that man-made changes to the environment do not have harmful effects on humans.

It is useful to consider that environmental policy comprises two major terms: environment and policy. Environment primarily refers to the ecological dimension (ecosystems), but can also take account of social dimension (quality of life) and an economic dimension (resource management). Policy can be defined as a "course of action or principle adopted or proposed by a government, party, business or individual".

Thus, environmental policy focuses on problems arising from human impact on the environment, which retroacts onto human society by having a (negative) impact on human values such as good health or the 'clean and green' environment.

Environmental issues generally addressed by environmental policy include (but are not limited to) air and water pollution, waste management, ecosystem management, biodiversity protection, and the protection of natural resources, wildlife and endangered species. Relatively recently, environmental policy has also attended to the communication of environmental issues

**Rationale for environment policy**

The rationale for governmental involvement in the environment is market failure in the form of externalities, including the free rider problem and the tragedy of the commons. An example of an externality is a factory that engages in water pollution in a river. The cost of such action is paid by society-at-large, when they must clean the water before drinking it and is external to the costs of the factory. The free rider problem is when the private marginal cost of taking action to protect the environment is greater than the private marginal benefit, but the social marginal cost is less than the social marginal benefit. The tragedy of the commons is the problem that, because no one person owns the commons, each individual has an incentive to utilize common resources as much as possible. Without governmental involvement, the commons is overused. Examples of tragedies of the common are over fishing and overgrazing.

## 3.2 ENVIRONMENTAL POLICY INSTRUMENTS

Environmental policy instruments are tools used by governments to implement their environmental policies. Governments may use a number of different types of instruments. For example, economic incentives and market-based instruments such as taxes and tax exemptions, tradable permits, and fees can be very effective to encourage compliance with environmental policy.

Voluntary measures, such as bilateral agreements negotiated between the government and private firms and commitments made by firms' independent of government pressure, are other instruments used in environmental policy. Another instrument is the implementation of greener public purchasing programs.

Often, several instruments are combined in an instrument mix formulated to address a certain environmental problem. Since environmental issues often have many different aspects, several policy instruments may be needed to adequately address each one. Furthermore, instrument mixes may allow firms greater flexibility in finding ways to comply with government policy while reducing the uncertainty in the cost of doing so. However, instrument mixes must be carefully formulated so that the individual measures within them do not undermine each other or create a rigid and cost-ineffective compliance framework. Also, overlapping instruments lead to unnecessary administrative costs, making implementation of environmental policies more costly than necessary In order to help governments realize their environmental policy goals. the OECD Environment Directorate studies and collects data on the efficiency of the environmental instruments governments use to achieve their goals as well as their consequences for other policies. The site www.economicinstruments.com serves as a complementary database detailing countries' experience with the application of instruments for environmental policy.

The current reliance on a market based framework is controversial; however, with many prominent environmentalists arguing that a more radical, overarching. approach is needed than a set of specific initiatives, to deal coherently with the scale of the climate change challenge. For an example of the problems, energy efficiency measures may actually increase energy consumption in the absence of a cap on fossil fuel use, as people might drive more efficient cars further and they might sell better. Thus, for example. Aubrey Meyer calls for a 'framework based market' of contraction and convergence examples of which is ideas such as the recent Cap and Share and 'Sky Trust' proposals.

Various instruments are used by regulators to induce consumers and producers to undertake a level of activity (be it pollution control, fishing, reforestation, etc.) that coincides with the level that maximizes social welfare. These include the imposition of standards, the use of economic and financial instruments, etc. A large portion of the literature in environmental economics is devoted to comparing the relative merits of these various instruments. In order to choose among these instruments, a number of criteria are being selected. Considered below are some of the criteria that are implicitly or explicitly used to guide the choice of instruments.

The policy instruments are designed to internalize the external cost of pollution, making the polluter pay, and at the same time minimize the cost of a given level of abatement under given conditions with regard to tastes, production and abatement costs, etc. These include Command and Control (CAC), Market Based Instruments (MBI) and Price instruments such as various forms of charges, subsidies, deposit refund systems and liabilities which fix prices and let the agents respond through quantity adjustment, or quantity instruments like tradable permits which fix emission quantities and allow agents to clear the pollution through price adjustments.

We begin our discussion with Property Rights followed by the Command and Control policies for pollution control.

**Property Rights The Command and Control (CAC) policies for pollution Control**

**The Normative theory of Externalities and Market Based Instruments (MBI)**

The Pigouvian Prescription

Pollution Taxes or Pollution Permits, which is better!

**Second Best Approaches Involving Mix of Regulation and MBI's Alternative Economic Instruments**

Direct Economic Instruments

Indirect Economic Instruments

**Other Supportive Measures**

## 3.2.1 Property Rights

Property rights are important for the well-functioning of a market. Without property rights, even the most ordinary market transactions are difficult. Property rights make big difference in whether a market will allocate goods and bads efficiently. This can be understood with a simple example. Consider two people, a polluter and a victim. The conventional view of the problem is that the polluter is the source of the problem and that blame must fall on the polluter's shoulders. However, leaving aside any preconceptions of right and wrong, the victim could also be blamed for being next to the polluter. Without the victim, the pollution would not be a problem. Morally, it seems that responsibility for cleaning up the pollution should fall on the factory. This issue can be solved through the allocation of property rights. As we know consumers and producers make decisions on the basis of the private costs and benefits they are facing. Social costs

and benefits may differ from the private costs and benefits faced by consumers and producers. Often Private agents base their decision on private costs as opposed to social costs because they do not have to support in any way the external costs associated with their consumption and production activities. Similarly they base their decision on private benefits as opposed to social benefits because they cannot extract a payment from the recipients of the external benefits.

**What happens in the absence of Property Rights?**

The next step in our analysis is the following: why do consumers and producers not have to pay for the external costs their activities generate? Similarly, why can they not extract payment from those enjoying the external benefits? The answer to these questions lies in the absence of property rights. Since many aspects of the environment e.g. a typical fishery or forest do not belong to any private parties, there is no one to compensate for using these goods. The price of using the environment, a public good, or an open access resource is effectively nil. If these goods were to belong to private parties, a price would have to be paid for using these resources. The simple solution to externalities would therefore appear to be to privatize property rights.

**The Polluter or the Victim: Who should have the rights?**

The next issue to be addressed is as to whom should private property rights be allocated? To those generating the external costs (such as the polluters), or to those whose welfare is adversely affected by the external costs (such as those whose health is damaged by the pollution)? Is it possible to allocate the property rights to ensure that the social optimum will be reached? As noted earlier , Ronald Coase (1960) showed that in the absence of transaction costs, the social optimum could be reached (e.g. the optimal level of pollution, the optimal amount of trees cut, of land protected, of reforestation, of environmental protection, etc.) whether property rights are initially allocated to polluters or to those suffering from the pollution. This result has come to be known as the Coase theorem. It is demonstrated below with the help of a specific example.

Suppose a plant is discharging pollution into a lake, and that the water of the lake is used for consumption and for irrigation by a community living by the lake. Suppose that the benefit for the plant to discharge its pollution in the lake is $1000 (for example, this may mean that it would cost $1000 for the plant to stop discharging in the lake by

reducing its pollution or by discharging in some other location). Suppose that the benefit for the community of using the lake is $1200 (for example, this may mean that if the community had to stop using the water of the lake, it would have to pay $1200 to obtain water from some other sources). Given these values, the social optimum in this case requires that the lake be used by the community for consumption and irrigation purposes since it is in this use that the lake creates the largest value. In what follows, we will show that if we allow negotiation between the plant owner and the community, the lake will be used for consumption and irrigation by the community irrespective of who owns the property right over the lake.

First suppose that the property right is allocated to the polluter. Since it would cost $1000 for the plant to stop using the lake to discharge its pollution, the plant would accept any compensation above $1000 to stop discharging in the lake. On the other hand, it costs $1200 for the community not to use the water of the lake. The community would be willing to pay up to $1200 to be able to use the water from the lake and still be better off. Since the community is willing to pay more than what the plant would require to stop its discharges, there is room for negotiation. Negotiation will result in the community compensating the polluter to induce him to stop polluting the lake. The lake will be therefore be used for consumption and irrigation by the community. The optimum is therefore reached even if the property rights are allocated to the polluter.

Suppose on the other hand that the lake belongs to the community. Since it would cost $1200 for the community to stop using the lake, the community would accept compensation greater than $1200 to stop using the water of the lake. However, the plant would be willing to pay at most $1000 to obtain the right to discharge in the lake. There is in this case no possibility for negotiation and the lake will be used for consumption and irrigation by the community.

**The Problems with allocation of Property Rights**

As we have seen, the optimum is reached no matter whoever is allocated the property right. For this result to be obtained however, certain important conditions needs to be satisfied. The conditions are as follows first, it must be possible to define property rights precisely. Secondly, this property right must be enforceable, and transferable. Indeed, the property right is of no meaning if abuse of the property right by a third party

cannot be prevented. Thirdly, parties to the transaction must be well defined. This may be particularly difficult when today's actions affect future generations, by definition, these cannot be part of current negotiation. Fourth, those owning the property rights must be able to capture all values associated with the environmental asset they own. In the forestry sector for example, this is generally a problem since the property right is typically defined solely over the wood value of the forest, and not over the entire value of the forest, which goes beyond simply its wood value. Finally, transaction costs must be small. When the number of polluters and polluters is large, this condition will likely not be satisfied.

For all the above reasons, the conditions under which the allocation of private property rights may restore social efficiency restrict the applicability of property rights in practice. Hence it is necessary to look at other ways of achieving the social optimal solution.

### 3.2.2 Command and Control Regulation

A review of the evolution of environmental policies in developed countries such as the USA, UK, France, and Germany, the Netherlands and in many developing countries including India, shows that historically governments have tended to rely on direct regulation or the command and control (CAC) type policies for pollution control. Although it can take many forms, the basic concept of command and control is for the regulator to specify the steps individual polluters must take to solve a pollution problem.

The essence of command and control is that the regulator collects the information necessary to decide the physical actions to control pollution, the regulator then commands the polluter to take specific physical actions to control the pollution. The regulator is generally quite specific as to what steps needs to be taken.

**Forms of Command and Control**

Command-and –control regulations can take many forms. By means of regulation, the regulator commands a desired behavior, typically by imposing a limit on the amount of emissions that a polluter can produce. These limits are generally called emissions standards. The regulator then controls and enforces compliance with the desired behavior. Under this regime, the incentives for pollution control take the form of penalties or sanctions that the polluter is faced with if it does not comply with the command. For

instance, the clean Air Act requires the EPA (Environment Protection Authority) to determine the minimum pollution control "performance" of new sources of pollution. Command and control may also be combined with significant fines and penaltics associated with non - compliance.

**The Pros and Cons of Command and Control**

There are several pros and cons of command and control. Command and Control regulation are more flexible in regulating complex environmental processes and thus much greater certainty in how much pollution will result from regulations. The disadvantage in command and control is that the informational cost is high. The regulator often needs to rely on information from the polluter, either in terms of emissions or costs of control, because of this; the polluter has an incentive to distort information provided to the regulator.

Due to the drawbacks in the CAC type of regulation we can observe a gradual shift from the CAC type of regulation towards regulation based on use of economic instruments. In India the Policy Statement for Abatement of Pollution dated 26 February 1992 aims at giving 'industries and consumers clear signals about the cost of using environmental and natural resources'. It expects that 'market-oriented price mechanisms will influence behaviour to avoid excessive use of natural resources.

## 3.2.3The normative theory of Externalities and Market Based Instruments (MBI)

**The Pigouvian Prescription**

Since 1981 there has been a gradual shift from the CAC type of regulation towards regulation based on use of economic instruments. The Normative theory of externalities, which lays the foundation for use of MBI's in pollution control goes back to the pioneer work of Pigou (1920). According to his analysis the social optimum and the private optimum differ because while the former is based on the condition of equality between marginal social cost and marginal social benefit, the latter is based on the condition of equality between marginal private cost and marginal private benefit. The divergences between social and private benefits or costs are what economists call externalities. Pigou recommended taxes on activities generating negative externalities and subsidies on activities generating positive externalities as means of internalizing

externalities and bringing the choice of the firm in line with what it would have been had it faced the true social cost (benefit) of production.

Determination of the Pigouvian tax, even in a simple model, involves information about the marginal rate of substitution between income and the pollutant for different individuals and the effect of an additional unit of waste discharge on the level of pollution. Also, the marginal product has to be evaluated at the social optimum point. When there is no pollution control, the firms may be discharging wastes beyond the levels consistent with a social optimum. Hence, it becomes difficult to derive the shape of damage function empirically.

The market structure and type of regulation will also influence the responses of the firms. If for example, producers' prices are administered on the basis of retention price formula and if a firm's capacity utilization exceeds the target level then the firm has no disincentive to incur costs in creating and operating as abatement plant. Even for a profit-maximizing firm in a competitive market, the level of pollution abatement will depend on the nature of institutional mechanisms for monitoring and enforcing pollution control measures.

Hence these problems make the task of deciding the level of tax and assessing the effect of the tax on pollution abatement in an industry difficult.

**Pollution Taxes or Pollution Permits, which is better!**

As an alternative to the Pigouvian tax, an environmental protection agency can issue tradable pollution permits, equal in aggregate amount to a socially optimal level of pollution, and allow the firms to bid for them. Robert and Spence (1976) recommended a mixture of marketable permits supplemented by an effluent fee and a subsidy when the regulator is uncertain about the marginal abatement cost function of polluters. The scheme is as follows: The regulator issues a number of marketable emission permits and the market determines the equilibrium price of permit. The polluters are allowed to generate emissions without permits or in excess of the amounts allowed by their permit holdings, but they have to pay charges at the rate of f per unit of excess emissions. The polluter gets a subsidy at the rate of s for their unused permits. The rates should satisfy the condition s<=p<=f, where p is the permit price. The mixed system 'produces levels of the effluents, conditional on costs, that reproduce exactly the effluents that would occur if

(1) the polluting firms were merged (and made cleanup decisions centrally) and (2) they faced a piece wise linear penalty function of the form P (X) = sx + p Max (x-1, 0), where x is the level of emission and 1 is the quantity of permit.

In fact Pollution permits are a combination of command and control and market-based approaches to the task of limiting pollution emissions. Polluters can bid for a permit that allows them to create a fixed amount of pollution. These permits can be resold: The government can gradually reduce the number (volume) of pollution permits available so that total pollution emissions can be controlled.

- If you can sell a permit for more than it is worth to you -- you do so
- If you can buy a permit for less than it is worth to you -- you do so

If a company (X) has a high marginal benefit from pollution emissions – it will be willing to buy some permits from another business (Y) who has a lower marginal benefit from emitting pollution.

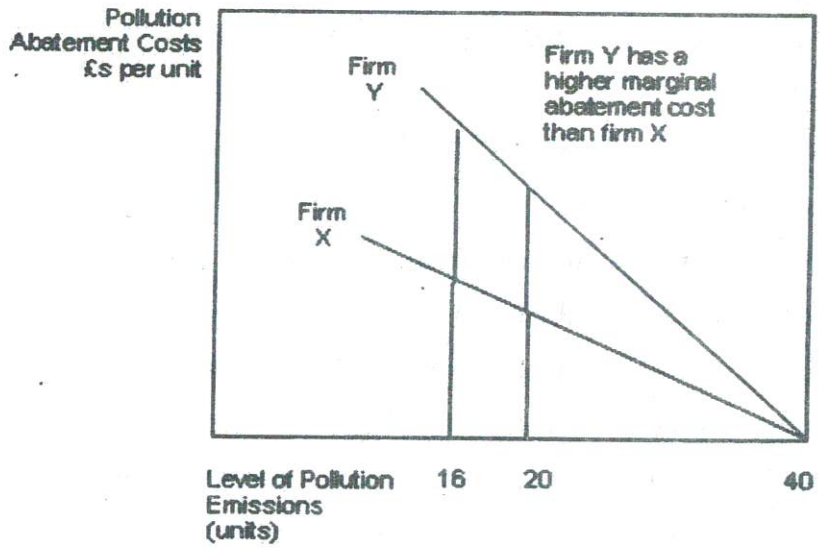


**Figure 8**

Assume initially that both firms X and Y are producing 20 units of a pollutant each from their output. The government may decide that only eighteen units of pollution is permissible for each firm. If firm X manages to reduce pollution emissions to sixteen units it would be a given a credit of 2 units.

This permit could be traded with firm Y – allowing Y to continue producing twenty units of the pollutant. The effect is that total pollution emissions still falls to

thirty six units (for the two firms combined) - but the systems of traded permits means that pollution reduction is concentrated in the firms where pollution abatement can be achieved at the lowest cost.

The market for permits will reach a market-clearing price where the marginal benefit of pollution emissions is equal. Businesses can either buy permits or invest in technology to reduce pollution emissions - whichever approach saves them money. Gradually the total amount of pollution allowed can be reduced – as the stringency of pollution limits is tightened, so the value of permits may rise, they will be more valuable to companies that can bring down pollution levels at lowest marginal cost.

Marketable permits have been tried in several countries – including Singapore where an auction mechanism has been introduced for the trading of ozone-depleting substances. For the system to be effective there needs to be common acceptance of the legal framework for the trading of permits and regulation of the amount of pollution produced. The Kyoto Summit on Climate Change (held in December 1997) witnessed a decisive move towards a greater use of internationally traded pollution permits – based on the idea that each country is required to achieve a specific percentage reduction in pollutants such as C02.

**Potential problems with traded pollution permits:**

- How are permitted levels of pollution decided? If based on current production levels they may be no advantage for firms that have *already* taken steps to control their pollution emissions
- Traded permits may see pollution being concentrated in certain geographical areas. At the Kyoto Summit, developing countries were not required to make reductions in pollution – but could be given credits for "certified reductions" in pollution that could be then traded with other countries. This might allow countries such as the United States to buy up pollution permits from LDC's (including many form high polluting countries in Eastern Europe) – and avoid the need to reduce pollution themselves
- There are likely to be high administrative costs associated with monitoring pollution emissions – particularly if the number of firms involved is very large.

### 3.2.4 Second Best Approaches Involving Mix of Regulation and MBI's

The Command and Control (CAC) policies in the form of direct regulation: bans, setting of standards, etc., have increasingly come under criticism on the ground that they are sub-optimal in terms of social welfare maximization, i.e., they do not in generally yield production-pollution-abatement outcomes which equate the social marginal benefit to abatement with its social marginal cost.

Economists since the time of Pigou have come up with various designs of ma .et based policy instruments which can satisfy the social welfare maximizing condition as demonstrated earlier. However these properties of MBIs have typically been demonstrated under highly simplified assumptions with regard to information on the tastes of consumers, damage functions (abatement benefits) and the production and abatement costs of firm.

**Alternative Economic Instruments**

As the knowledge about the links between emissions, effluents and the solid wastes generated and the environmental effects on health, crops, assets and ecosystem are very limited, economists have developed methodologies to measure the benefits of goods such as clean air or water that are not sold in markets. Cropper and Oates (1992) classify these methods into two broad categories: (a) indirect methods, which attempt to infer from actual choices, such as choosing where to live, the value people place on environmental goods' and (b) direct questioning approaches, which ask people to make trade offs between environmental and other goods in a survey context.

In developing countries like India, the problem of valuation of benefits from environmental protection is very difficult not only because of the nonexistence of markets for most environmental resources also because of many imperfections in the markets for factors and intermediate inputs. There is, therefore, a growing consensus that economic instruments such as charges or permits should be combined with direct regulation measures like standards.

There are a number of alternative economic instruments which are designed to internalize the external costs of pollution, making the polluter pay, and at the same time minimize the cost of a given level of abatement under given conditions with regard to tastes, production and abatement costs, etc. These include price instruments such as

various forms of charges, subsidies, deposit refund systems and liabilities which fix prices and let the agents respond through quantity adjustments, or quantity instruments like tradeable permits which fix emission quantities and allow agents to clear the pollution market through price adjustments.

- **Direct Economic Instruments**
- **Indirect Economic Instruments**

The **Direct Economic** Instruments are

- Pollution Taxes/Charges
- User Charges.
- Marketable Pollution Permits
- Deposit Refund Systems
- Performance Bond
- Strict liability for pollution

The **Indirect Economic** Instruments are

- Product Tax/Charge
- Input Tax/Charge
- Taxes on complements and subsidies for substitutes
- Fiscal incentives
- Eco certification of products and environmental audit

The Direct economic instruments are preferred when the costs of observing, measuring and monitoring pollution levels are not high. Interplant variations in effluent/emission levels due to differences in plant vintages, processes, raw materials and energy used and temporal variations, both in quantity and quality of pollution, as well as their damage intensities; raise the costs of measurement and monitoring.

- **Pollution Taxes/Charges:** It is suggested that the polluters should be taxed for the privilege of polluting so that they will want to pollute less. According to Pigou, a tax or charge on a pollutant at the point, where the marginal social cost of pollution equals the marginal damage from pollution, will result in an optimal level of pollution. Thus the charge/tax can force the polluter to pay for the external costs of pollution and to incorporate the added taxes into their business

decisions. It also provides incentives for business to develop and adopt improved pollution control technologies.

- **User Charges:** User charges are commonly used for the disposal of water wastes and solid wastes. Water user charges generally follow a two-part tariff structure
  (a) a flat rate independent of volume of wastewater and
  (b) a charge per unit of wastewater discharged. User charges for disposal of household solid wastes and industrial wastes follow a similar pattern. For household wastes the charge is based on the pollution load. In some countries the user charge is not based on the pollution load but is tied to property tax, the reason being administrative convenience. However, many countries have initiated or are in the process of introducing charges, which vary with the type of waste.
- **Marketable Pollution Permits:** Under this system when the pollution happens to be uniformly dispersed, an environmental authority sets target for a region in terms of a particular air pollutant. The targets are translated into X number of pollution permits. These permits are allocated among the existing enterprises on the historical pattern of emissions ('grand fathering') or the permits may be auctioned. These permits are tradable and the prices of permit p, is determined in the market for the pollutant. Polluters with abatement costs below the permit price have an incentive to undertake abatement. The emission reductions by terms with low abatement costs are certified by the environmental certificates (ERCs). These ERCs can be sold to other polluting firms whose abatement costs are higher than the permit price.
- **Deposit Refund Systems:** In this system the potential injurers are subjected to a tax (deposit) in the amount of the potential damage and receive a subsidy (refund) equally large in terms of present value, if certain conditions are met, for example, proof that a product is returned to a specified place or that a specified type of damage has not occurred.
- **Performance Bond:** A production oriented deposit refund system is known as performance bond. The potential entrant in this activity has to deposit an amount equal to the expected restoration costs and the deposit would be refunded when

the site is restored in such a way as to meet environmental standards. This scheme is applicable to new chemicals whose environmental effects are known. The producers of the new chemical bear the cost of risk.

- **Strict liability for pollution:** Liability as a policy instrument for damages is recognized in common law. This scheme holds promise in situations where information about potential damage is scarce, the discharges are stochastic, monitoring is difficult and the polluter has financial capability to pay the necessary compensation in the event of damage. As the imposition of such liability shifts the cost of risk to the polluter, he has an incentive to engage in preventive measures. Like a Pigouvian tax, strict liability internalizes the external costs.

**The Indirect economic instruments are**

- **Product Tax/Charge:** If output and pollutant are joint products, i.e., there is a proportional relation between the two, then the environmental objective can be achieved either by a tax on the pollutant or on the output. In many industries, pollution per unit of output varies from firm to firm depending on the vintage of the plant, the process used, the fuel input used and location of the plant. Thus an output tax does not distinguish between a 'clean' plant and a polluting plant. As an incentive for a firm to use clean technology or to erect and operate an abatement plant, the firm may be given rebate/exemption from the tax.
- **Input Tax/Charge:** An input tax is a tax on water consumption or a tax on the quantity of energy used or a tax on any input whose use generates pollution. It is easier to measure and monitor than a direct tax on pollution. Along with input tax, exemptions may be given to firms with clean technologies and rebates may be given to plants, which undertake pollution abatement. A gasoline tax is a good instrument for dealing with environment problems related to the burning of gasoline, such as the emission of air pollutants. This tax can provide significant energy-security benefits by reducing a country's demand for the import of crude oil. Almost all European Countries have fuel taxes. The tax rates vary depending on pollution generating characteristics of different fuels. Taxes minerals, water and other scarce inputs can encourage conservation.

**Taxes on complements and subsidies for substitutes:**

Subsidies for products, which are eco-friendly, e.g., organic manures and organic pesticides can discourage use of chemical fertilizers and chemical pesticides. Similarly taxes on automobiles based on their weight or pollution generating capacity can result in the conservation of energy.

There is also scope for using the tax/subsidy instrument for correcting existing price distortions. At present prices of items such as irrigation water, electricity for farmers, fertilizers are under priced due to political and other reasons. Under pricing of these goods does not provide any incentive to the users to conserve the scarce resources. Economic pricing of these items will reduce excess demands, encourage conservation and give signals to the users about the social scarcities of these goods.

- **Fiscal incentives:** Fiscal incentives for improving environmental quality include rebates on excise duty/customs duty/sales tax on machinery and equipment used for pollution abatement or adoption of clean technologies, accelerated depreciation allowances to encourage adoption of clean technologies or to erect abatement plans, soft loans/subsidies for setting up common effluent treatment plants and recycling and conservation activities.
- **Eco certification of products and environmental audit:** This method involves labeling of environment friendly products. This scheme operates on a national basis and provides accredition and labeling for household and other consumer products, which meet certain environmental criteria along with quality requirements of the Nations Standards for that product.

**The specific objectives of the scheme are as follows: -**

i. To provide an incentive for manufacturers and importers to reduce adverse environmental impact of products.
ii. To reward genuine initiatives by companies to reduce adverse environmental impact of their products.
iii. To assist consumers to become environmentally responsible in their daily lives by providing information to take account of environmental factors in their purchase decisions.

iv. To encourage citizens to purchase products which have less harmful environmental impacts.

v. Ultimately to improve the quality of the environment and to encourage the sustainable management of resources

### 3.2.5 Other Supportive Measures

In many countries adoption of clean technologies is mandatory for new firms. Existing firms are often required to use abatement technologies within specified periods. Development of pollution-free technologies can be encouraged by providing government support for basic research in this area, and by grants and patent policies to the investors. Public good characteristics of R & D and inventions favour government support for these activities.

Administrative regulation can also take the form of a zoning cum incentive scheme designed to internalize the externalities. For example, an industrial complex consisting of sugar mills, distilleries, paper mills using bagasse as raw material, and farms, which can use wastewater discharged from these factories, can internalize the externalities. The Government can also evolve location policies for polluting industries in a region to facilitate collective abatement efforts. It can also invest in public infrastructure for pollution abatement, e.g., common treatment plants for effluent discharges for small firms and municipal wastes where individual abatement plants are not economically viable.

The Government can also take a number of measures to strengthen the legal systems in the interest of improving environmental quality. This can be achieved in many ways. It can define property rights for environmental resources, wherever they are feasible. It can create markets for tradeable permits for uniformly dispersed pollutants such as greenhouse gases and water pollutants in a large river basin. It can enforce legal liability or administer a performance bond scheme for large firms, which use hazardous materials.

## 3.3 GOVERNMENT MONITORING AND ENFORCEMENT OF ENVIRONMENTAL REGULATION

Empirical studies of enforcement generally ask two questions: (1) how does the regulatory agency enforce its regulations? And (2) Does more enforcement lead to an increase in compliance or improvement in the environment? Although the first question is

primarily descriptive, it provides insight into whether the enforcement authority targets its efforts and whether it acts as if it is interested in an efficient enforcement scheme. The second question often leads to policy implications such as whether monitoring or penalties should be increased or decreased. Although empirical studies have demonstrated the effectiveness of government activities such as inspections and monitoring, one must take care in drawing strong policy implications from these studies. Each empirical study is necessarily limited by the scope of the data and choices made by regulatory authorities.

Further, few studies have attempted to characterize the social costs and benefits of government monitoring or enforcement activities. Thus, a finding that increased monitoring leads to increased compliance, for example, does not tell us if the marginal cost of increased monitoring is outweighed by the benefits of increased compliance. It also does not tell us if there are other less costly methods of monitoring and enforcement or more productive methods that could be employed for the same level of government expenditures.

Environmental regulators in developing countries are trying fresh approaches and finding new allies in the battle to curb pollution. These initiatives stem from a widespread recognition that traditional pollution regulation is inappropriate for many developing nations. New regulatory institutions are often unable to enforce conventional standards for discharges from factories. Many regulators also recognize that such standards are not cost-effective, because they require all polluting factories to toe the same line, regardless of the costs of abatement and local environmental conditions.

Developing country regulators are now breaking out of this one-size-fits-all approach, opting instead for more flexible and efficient systems that provide strong incentives for polluters to clean up. Some of these pioneers have turned to charging polluters for every unit of their emissions. Experience in Colombia, China and the Philippines has shown that many managers institute serious pollution control when they face steep, regular payments of this kind. Such charges generate public revenue as well as cutting emissions – and this, in turn, can be used to support local efforts to control pollution.

Other environmental reformers are using rating systems that give public recognition to factories that adhere to pollution standards – and to train the communal eye on those that do not. By classifying factories on their emissions, and widely broadcasting the results, they enable communities to identify serious polluters and to pressure them to clean up. Investors, lenders and consumers, concerned over liability from poor environmental practices and wanting to reward green manufacturers, also bring pressure to bear. Public disclosure programmes have been particularly effective in curbing pollution at modest cost in Indonesia and the Philippines, and have proved potent even in places where formal regulation is weak or absent.

Public education on the sources and impacts of pollution also provides a powerful lever for improving the lives of poor people, who suffer greatly from emissions. Armed with good information, poor citizens can work with environmental agencies and elect political leaders willing to pressure factories to curb pollution.

Apart from all the studies countries like India are putting quite a good effort in monitoring and enforcement of environmental regulation.

See Appendix 1 to have clearer knowledge about the regulations in India.

## 3.4 INTERNATIONAL TRADE AND ENVIRONMENT IN WTO REGIME

Trade and environment intersect in many ways. Aside from the broad debate as to whether economic growth and trade adversely affect the environment, linkages are recognized between existing rules of the World Trade Organization (WTO) and rules established in various Multilateral Environmental Agreements (MEAs). Controlling greenhouse gas emissions (GHGs) promises to be a top priority for both national and international agendas, and special attention has been given to the relationship between the WTO and the emerging international regime on climate change.

**WTO and Environment**

The WTO is not a global environmental protection agency; its competence is limited to the trade-related aspects of environmental policies (WTO 2007). However, the international trade regime has recognized the connection between trade and environment for some time. During the GATT era, trade-related environmental issues were often

discussed in negotiating rounds. The WTO era has seen important progress in linking trade and environment.

The WTO Ministerial Decision on Trade and Environment, adopted in the Marrakesh Agreement that created the WTO, acknowledged the importance of sustainable development and called for creation of the Committee on Trade and Environment (CTE). Since it was established, the CTE has carried out significant technical work.

The following two exhibits will give you the clear picture of WTO regime for environment protection.

**The Doha Mandate**

At the Doha Ministerial Conference in 2001, WTO members agreed to launch negotiations that would address the nexus between trade and environment. The Doha Declaration includes a negotiating mandate on clarifying the relationship between MEA and WTO rules. Also, to improve market access to environmental goods and service, the Declaration called for negotiations on "the reduction or, as appropriate, elimination of tariff and non-tariff barriers to environmental goods and services." While WTO members have devoted considerable effort to fulfilling these mandates, like much else in the Doha Declaration, results are yet to be achieved.

Diving into the details, the Doha Declaration adopted on November 14, 2001 lists several objectives concerning trade and environment. Paragraph 31 of the Declaration mandates negotiations on three issues: (i) the relationship between WTO rules and specific trade obligations set out in MEAs; (ii) procedures for regular information exchange between MEA secretariats and the relevant WTO committees; and (iii) the reduction or elimination of tariff and non-tariff barriers to environmental goods and services. To fulfill the mandates described in paragraph 31(i) and (ii), cooperation between the WTO and MEAs is underway (WTO 2009). With respect to climate change in particular, UNFCCC representatives attend the regular WTO CTE meetings and the WTO secretariat attends UNFCCC COP meetings.

Paragraph 32 of the Declaration instructs the CTE to work on: (i) the effect of environmental measures on market access, especially in relation to developing countries; (ii) the relevant provisions of the Agreement on Trade-Related Aspects of Intellectual

Property Rights (TRIPs); and (iii) labeling requirements for environmental purposes. As mentioned, results are yet to be seen. But gatherings of world leaders, most recently the Group of 20 London Summit in April 2009, and the Group of Eight L'Aquila Summit in July 2009, urgently call for the conclusion of the Doha negotiations.

**UNFCCC and Trade**

The main objectives of the UNFCCC and the Kyoto Protocol are to combat climate change and to promote sustainable development. Key public officials in the European Union, the United States, China and India have already begun to lay down verbal "markers" on the role of trade measures in addressing climate change. But so far there have not been extensive trade discussions within the UNFCCC and Kyoto Protocol talks. Earlier declarations, echoing the chapeau of GATT Article XX, explicitly acknowledged that measures taken to combat climate changes should not distort international trade. Article 3.5 of the UNFCCC states:

"The Parties should cooperate to promote a supportive and open international economic system that would lead to sustainable economic growth and development in all Parties, particularly developing country Parties, thus enabling them better to address the problems of climate change. Measures taken to combat climate change, including unilateral ones, should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade."

Article 2.3 of the Kyoto Protocol states:

"The Parties included in Annex I shall strive to implement policies and measures under this Article in such a way as to minimize adverse effects, including the adverse effects of climate change, effects on international trade, and social, environmental and economic impacts on other Parties, especially developing country Parties and in particular those identified in Article 4, paragraphs 8 and 9, of the Convention, taking into account Article 3 of the Convention."

At the 13th Conference of the Parties (COP) meeting of the UNFCCC in Bali in December 2007, countries agreed to launch negotiations to write a successor accord to the Kyoto Protocol. This negotiating process is supposed to be concluded at the 15th UNFCCC COP meeting in Copenhagen in December 2009. As the deadline is rapidly approaching, debate on designing a policy framework for the post-Kyoto era has raged at

both national and international levels. While countries have repeatedly affirmed the importance of a successful conclusion in Copenhagen talks, however, a comprehensive deal seems unlikely to be sealed in 2009, due to large gaps between the positions expressed by developed and developing countries.

At an informal group meeting under the Ad Hoc Working Group on Long Term Cooperative Action (AWG-LCA) held in August 2009 in Bonn, India proposed the inclusion of a draft paragraph in the negotiating text, which reads as follows:

"Developed country Parties shall not resort to any form of unilateral measures including countervailing border measures, against goods and services imported from developing countries on grounds of protection and stabilization of climate. Such unilateral measures would violate the principles and provisions of the Convention, including, in particular, those related to the principle of common but differentiated responsibilities (Article 3, Paragraph 1); trade and climate change (Article 3 paragraph 5); and the relationship between mitigation actions of developing countries and provision of financial resources and technology by developed country Parties (Article 4, Paragraphs 3 and 7)."

Yet while developing countries are seeking ways to prevent countries from using border measures against them, the US Congress is seeking ways to address competitiveness concerns and incorporate them into the post-Kyoto treaty.

In June 2009, the WTO and the United Nations Environment Programme (UNEP) released a joint study, Trade and Climate Change, the first comprehensive study done by the WTO Secretariat that examines the nexus between trade and climate change. When this report came out, some newspapers printed misleading headlines, such as "WTO: Some trade limits OK to stop climate change." The headlines were based on a statement in the report which reads:

"The general approach under the WTO rules has been to acknowledge that some degree of trade restrictions may be necessary to achieve certain policy options as long as a number of carefully crafted conditions are respected. WTO case law has confirmed that WTO rules do not trump environmental requirements."

It is true that the WTO does not play the role of "Doctor No." Recent Appellate Body rulings show a growing sympathy with environmental concerns. However, the statement above should not be interpreted to mean the WTO will issue a hall pass to any trade restriction implemented in the name of environmental protection. Rather, attention should be placed on the phrase stating that "as long as a number of carefully crafted conditions are respected." The report emphasizes that compliance with the WTO rule book heavily depends on specific design features. Unfortunately, but understandably, the report does not seek to answer which policy options would pass muster under the WTO rule book, and how climate change policies can best be crafted to be consistent with WTO principles.

At the release event for the WTO/UNEP report, Pascal Lamy, Director-General of the WTO, said that an international agreement on climate change should come first before the WTO would begin work on determining the WTO compatibility of trade measures related to climate change. He emphasized that the relationship between trade and climate change would be best defined by an international accord on climate change that embraces all polluters. Lamy asserted that WTO members want trade addressed as part of an overall post-Kyoto treaty, and they do not want a separate Geneva-based WTO negotiation on permissible trade-related climate measures.

With this background in mind, we turn now to several options. Some are mutually exclusive, but some could be pursued on parallel tracks.

**UNFCCC Approach to Trade Issues**

The climate regime itself could act multilaterally to create norms on trade and climate. In fact, recently there has been some movement to do so. For example, the post-Kyoto regime may establish nonbinding principles for the use of trade measures for climate change and those principles could be considered by a WTO panel when a dispute arises.

However, given the wide differences of opinion between countries, it is unlikely that parties to the post-Kyoto accord will adopt binding rules that define a trade framework which is broadly satisfactory to WTO members. Current compliance mechanisms within the UNFCCC and Kyoto Protocol are not designed to deal with trade issues, and in any event they are weak. These features are likely to persist in the post-Kyoto era.

The WTO as an institution might prefer that a trade-related dispute pertaining to a MEA be resolved within the relevant MEA before landing on the WTO's doorstep. However, it is WTO members, not the WTO as an institution, that decide the forum for bringing disputes. It seems likely that many WTO members will want to use the tried and true machinery of WTO panels and the Appellate Body when they bring disputes.

**1. Case-by-Case Approach**

A straightforward way to determine whether disputed trade measures in support of GHG emission controls are compatible with WTO agreements is simply to let the WTO judicial process run its course. Eventually, following this approach, the Appellate Body will establish a record of decided cases that define the contours of WTO obligations. One shortcoming of the case-by-case approach, however, is that it could take a long time before clear guidelines become apparent. A big WTO case can easily take three years to run the full course -- from consultations, to a panel decision, and finally a ruling by the Appellate Body. As trade battles are fought, some countries may become more devoted to winning legal cases than to fighting the common enemy, climate change.

Another shortcoming of the case-by-case approach is that some countries, faced with an adverse ruling, may come to question the legitimacy of WTO pronouncements on a subject as contentious as climate change. If the Appellate Body is too lenient on trade-related climate measures, by according users of unilateral subsidies and barriers excessive deference, that could open the door to opportunistic protectionism and rent-seeking behavior. If the Appellate Body is too strict, countries may ask why the WTO is injecting itself as an opponent of GHG controls designed to save the planet. Either way, the case-by-case approach will put great pressure on the WTO system.

**2. Code Approach**

Key WTO members might negotiate a new code as a plurilateral agreement under Annex 4 of the WTO agreement. The code would create policy space for climate measures that are imposed in a manner broadly consistent with core WTO principles -- even if a technical violation of WTO law might occur. Measures that conform to this code would not be subject to challenge in WTO dispute settlement by governments subscribing to the code. Although such a code would require consensus of all WTO members to be formally added to the WTO agreement, this consensus might be politically

possible because it would not limit the rights of non-subscribing WTO members. Our book outlines possible elements of a new code in detail (Hufbauer, Charnovitz, and Kim 2009).

However, if negotiating a code as a WTO plurilateral agreement proves politically impossible, because non-subscribing members fear the precedents that would be set, then a group of like-minded member governments could negotiate a code outside the WTO. The advantage of acting outside the WTO is that non-participating countries could not block the negotiations. Of course, with an extra-WTO code, WTO dispute settlement mechanisms would not be available for enforcement. But that might not be a serious disadvantage because other forms of dispute settlement could be adopted.

As a plurilateral agreement inside or outside the WTO among like-minded countries, the code would not apply to countries that did not subscribe to it. The purpose of such a code would not be to regulate legal relationships between code members and non-members, but rather for participating governments to agree in advance to a framework for trade-related climate measures in order to head off disputes among those governments. The code approach would minimize the risks for exports of participating countries, and might to some degree limit the extent of subsidization through free allocations and exemptions.

However, the code approach has its own drawbacks. To maximize its effectiveness, the code should include the major emitting countries: the United States, the European Union, Japan, Brazil, India and China. This would not be an easy task, owing to the large difference of opinion on appropriate GHG controls between developed and developing countries. In practical terms, a code that emphasized sector standards and implicit carbon pricing might start out with very limited membership, perhaps just the United States, the European Union, Japan, and a few other advanced countries. In response, developing countries, speaking under the auspices of the Group of 77, might write their own code for climate and trade measures. Predictably, a G-77 code would emphasize the cumulated historical record of national emissions and current per capita levels as a basis for imposing trade restraints. The result of two conflicting codes could be a huge split between WTO members, with considerable damage to the world trading system.

**3. Amendment or Waiver**

Another idea being floated, even stronger than a plurilateral code, is to amend GATT articles and other parts of the WTO legal text to accommodate environmental controls. Within the WTO, legal text can be amended only by a consensus of members, which means that no member objects to the change. This is a difficult process.

A slightly less demanding approach would ask WTO members to approve a waiver to WTO obligations for trade commitments written in a climate agreement. A waiver, unlike a revision of the text, does not require a consensus among WTO members, but it does require approval from at least three-quarters of members. Whether this route has much promise largely depends on the extent of overlap between signatories to the climate agreement and the WTO membership. If a significant number of WTO members do not sign the climate accord, the prospects of a waiver seem slight.

**4. Stick to Your Knitting**

Rather than embark on a major modification of WTO rules, the members might decide to stick to the environmental topics flagged in the Doha mandate. Two were prominent: reducing trade barriers to environmental goods and services, and the dissemination of intellectual property rights with a bearing on climate change.

Trade barriers have been identified among the biggest impediments to the dissemination of low-carbon energy technologies and associated services worldwide. The threshold challenge is that internationally agreed definitions for environmental goods and services do not exist. Consequently, many countries have put forward their own lists of environmental goods and services. The Special Session of the Committee on Trade and Environment (CTE) has tried to nail down a list but it has not yet reached agreement.

Environmental goods are found in a wide range of industrial and trade classification nomenclatures. Under the Harmonized System (HS) of tariff nomenclature, environmental goods are often lumped together with unrelated products. Moreover, many goods have dual uses. There is also the issue of process and production methods (PPMs) -- can products be considered "environmental" based on the way they have been processed or produced? Finally, and perhaps most important, each country has different export interests.

While the WTO has no definition of environmental goods, the OECD, APEC, and World Bank have drawn up their own lists. Even though there are differences in product coverage, those lists have served as useful sources for studying the possible consequences of trade liberalization. To improve market access to environmental goods and services, members of the WTO would need to start by agreeing on the definition. Lists proposed by the OECD, the APEC, the World Bank, and the UNFCCC may be the answer. Negotiations on tariff reduction in environmental goods might move faster if separated from the broader talks on Non-Agriculture Market Access (NAMA).

Another piece of WTO turf is the technology transfer debate, which revolves around intellectual property rights (IPRs). Strong protection of IPRs has the potential to stimulate technology innovation but can also hinder technology transfer. While the BICs have asked for easier access to patented clean energy technologies and have proposed compulsory licensing regimes, the United States and other developed countries are vehemently opposed.

The WTO contains an agreement on trade-related aspect of intellectual property rights (TRIPS). The TRIPS agreement states its objective in Article 7:

"the protection and enforcement of intellectual property rights should contribute to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligations."

The Doha Declaration mandated the CTE to work on "the relevant provisions of the Agreement on Trade-Related Aspects of Intellectual Property Rights." Cosbey (ed. 2008) argued that the TRIPS agreement can foster technology transfer owing to so-called "TRIPS flexibilities" -- provisions that allow for certain limitations and exceptions to IPR protections. Of course many technology companies take exception to this interpretation. In our view, denial of patents and compulsory licensing by developing countries would spark the same sort of counterproductive friction as import penalties by developed countries. But these matters are clearly grist for "business as usual" negotiations within the WTO framework.

**5. Peace Clause**

At a much lower level of ambition than a code, amendment or waiver – and perhaps even lower than the reduction of trade barriers on environmental goods and services or the resolution of IPR issues, key WTO members may consider adopting time-limited "peace clauses" in their national climate legislation. The "peace clauses" would suspend the application of border measures on imports, and other extra-territorial controls, for a defined period of time – at least three years --while UNFCCC and W O negotiations are underway.

The great advantage of the peace clause approach is that it buys time. One disadvantage, as the WTO itself experienced with respect to the peace clause over agricultural subsidies adopted in the Doha Round, is that negotiations might not move with energy or speed. A second disadvantage is that, during the peace clause period, the urgency of limiting GHG emissions might be diluted. Some developed countries might go easy on their own GHG controls, out of competitive concerns. Some developing countries might feel less pressure to flatten their GHG trajectories.

**Activity 3**

1. What do you understand by environmental policy?
2. Discuss some of the environmental policy instruments. What is the relevance of property rights in environmental policy?
3. Give a brief note on UNFCC approach to trade issues.

## 3.5 SUMMARY

The traditional view of environmental economics is that environmental problems arise as a result of the presence of externalities. Government all over the world are leaving no stone unturned in implementing effective environmental policies to save their nations from the serious problems of environment pollution. International economic integration and growth reinforce the need for sound environmental policies at the national and international level. International cooperation is particularly important in addressing transboundary and global environmental challenges beyond the control of any individual

nation. This would be true even if nations did not trade with one another. Further in the unit various instruments of environmental policy have discussed in depth. International trade and environment in WTO regime also was explained along with trade issues and approaches to solve them.

## 3.6 FURTHER READINGS


- Baumol, W.J and W.E Oates (1988), The Theory of Environmental Policy. (2nd Edition), Cambridge University Press. Cambridge.
- McCormick, John (2001). Environmental Policy in the European Union. The European Series. Palgrave. p. 21.
- Bührs, Ton; Bartlett, Robert V (1991). Environmental Policy in New Zealand. The Politics of Clean and Green. Oxford University Press. p. 9.
- A major article outlining and analyzing the history of environmental communication policy within the European Union has recently come out in The Information Society, a journal based in the United States. See Mathur, Piyush. "Environmental Communication in the Information Society: The Blueprint from Europe," The Information Society: An International Journal, 25: 2, March 2009.


## APENDIX 1 - ENVIRONMENTAL REGULATIONS IN INDIA

**Indian Constitution – Article 48a:**

In the Directive Principles of State Policy, Article 48-A was inserted which enjoins the State to make endeavor for protection and improvement of the environment and for safeguarding the forest and wildlife of the country (42nd amendment w.e.f. 3 January 1977).

**Indian Constitution – Article 51-A (G)**

It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures (42nd amendment w.e.f. 3 January 1977).

## Environmental Regulations In India

| Year | Environmental Regulations |
|---|---|
| 1974 | Water (Prevention & Control of Pollution Act) Amendments, 1988 |
| 1975 | The Water (Prevention & Control of Pollution) Rules |
| 1977 | The Water (Prevention & Control of Pollution) Cess Act |
| 1978 | The Water (Prevention & Control of Pollution) Cess Rules |
| 1981 | The Air (Prevention & Control of Pollution) Act, Amendments, 1987 |
| 1982/ 1983 | The Air (Prevention & Control of Pollution) Rules |
| 1986 | The Environment (Protection) Act, Amendments (1989,1990,1993,1996,1997,1998,1999,2000,2001) |
| 1986 | The Environmental (Protection) Rules |
| 1992 | E (P) Act Notification – "Environment Statement" |
| 1994 | E (P) Act Notification – "Environmental Clearance" |
| 1997 | Amendments in the Environment Clearance, Notification – "Public Hearing" made mandatory |
| 1989 | The Hazardous Wastes (Management and Handling) Rules, Amendments, 2000, Draft Amendments 2002 |
| 1989 | Manufacture, Storage and Import of Hazardous Chemical Rules, Amendments, 1994, 2000 |
| 1991 | The Public Liability Insurance Act/Rules, 1992 |
| 1995 | The National Environment Tribunal Act |
| 1997 | Prohibition on the Handling of Azo dyes |
| 1997 | The National Environment Appellate Authority Act |
| 1998 | The Bio-Medical Waste (M&H), Rules |
| 1999 | Notification for making 100% Utilization of Fly-ash made mandatory |
| 2000 | Municipal Solid Waste (M&H) Rules |
| 2000 | Ozone Depleting Substance (R&C) Rules |
| 1999 | Regulation on recycling of Waste Oil and Non-ferrous scrape |
| 2000 | Noise Pollution (Regulations and Control) |
| 2001 | Batteries (M&H) Rules |

**Jurisdiction Of Environmental Legislation In India**

| **Central Government** | **State Government** |
|---|---|
| Ministry of Environment & Forest | State Deptt of Environment |
| **Regional Offices** | |
| Central Pollution Control Board | State Pollution Control |
| Zonal Offices (6) | Board / State Pollution ControlCommittee |
| Regional Offices | |

***1. The Water (Prevention And Control Of Pollution) Act, 1974***

- Provide information to the SPCB
- Provide access to the SPCB for taking samples
- Allow entry to the SPCB to ascertain that the provisions of the Act are being compiled with.

**Responsibilities:**

- Obtain "Consent to Establish"
- Obtain "Consent to Operate"
- Apply for renewal of the "Consent to Operate" before the expiry of validity period
- Consent to be deemed as granted automatically and unconditionally after four months from the date of application already given or refused before this period
- Refusal of "Consent" to be recorded in writing
- Pay Water Cess as indicated in the assessment order
- Affix water meters of the prescribed standards
- Provide access to SPCB
- Pay interest in case of delay in paying the Water Cess
- Pay penalty for non-payment of Cess
- Industry is entitled to 25% rebate if meeting certain conditions

***The Air (Prevention & Control Of Pollution) Act, 1981***

- Comply with the conditions in the "Consent to Establish" or "Consent to Operate"

- Not to discharge air pollutant(s) in excess of the prescribed standards
- Furnish information to the SPCB of any accident or unforeseen act or event
- Allow entry to the SPCB to ascertain that provisions of the Act are being complied with
- Provide information to enable SPCB to implement the Act
- Provide access to the SPCB for taking samples
- Comply with the directions issued in writing by the SPCB
- Obtain "Consent to Establish"
- Obtain "Consent to Operate"
- Apply for the renewal of "Consent to Operate" before expiry of the validity period
- Consent to be deemed as granted after four months from the date of receipt of application if no communication from the SPCB is received
- A prior "Notice of Inspection" to be served by the SPCB
- Industry to ensure that specified emission sampling procedure is being followed by the SPCB
- Opportunity to file objections with the SPCB within 15 days from the date of service of notice
- PCB to record reasons in writing in case it does not provide an opportunity to the industry to file objections

***Environment (Protection) Act, 1986***

- Comply with the directions issued by the Central Government. The direction may include:
  - closure, prohibition or regulation of any industry, or
  - stoppage or regulation of the supply of electricity, water or any other service
- Prevent discharges or emissions excess of the prescribed standards
- Furnish information of any accidental or unforeseen event
- Allow entry and inspection to ascertain compliance
- Allow samples to be taken
- Submit an "Environmental Statement" every year before 30th September to the SPCB

- Obtain prior "Environmental Clearances" from MoEF, in case of a new project or for modernization/expansion of the existing project

***The Hazardous Waste (Management And Handling) Rules, 1989, Amendments 2000***

- Check whether the waste(s) generated covered in Schedule 1 and 2 of the amendment rules, 2000
- If covered, apply in the Prescribed Format to obtain an "Authorization" for proper treatment and disposal of hazardous waste(s) and comply with the conditions specified in the authorization
- Take steps, wherever feasible for reduction, recovery and recycling of wastes
- Ensure proper collection, reception, treatment, storage and disposal of hazardous wastes
- Apply for renewal of authorization before expiry of the validity period
- Maintain records of hazardous wastes handling (Form 3)
- Submit "Annual Returns" to the SPCB (Form 4)
- Report to the SPCB any accident
- Labeling, Packaging, Transportation of HW as per Motor Vehicle Act, 1988 and Rules 1989

***The Hazardous Waste (Management And Handling) Rules, 1989, Amendments 2000, Draft Amendments 2002***

Draft Amendments, 2002 (Dt. 21st May 2002)

- Clarification on the definition of Hazardous Wastes
- List of hazardous waste according to schedule 1 is being modified
- Procedure for registration of re-processors of non-ferrous scrap and waste oil
- Schedule for hazardous wastes prohibited for import to and export from India

***Manufacture, Storage And Import Of Hazardous Chemical (Amendment) Rules, 1994, 2000***

- Identify whether the chemicals handled, used and stored or imported are covered in the Schedule 1 and/or 3 of the Rules, Schedule 2 for isolated storages.

**If covered in schedule 1:**

- Occupier to identify hazards associated with industrial activity and take adequate steps for prevention and control
- Occupier to provide relevant information to persons liable to be affected by a major accident
- Occupier to develop information in the form of a safety data sheet
- Occupier to notify the concerned authorities within 48 hours of the occurrence of a major accident
- Occupier to label the specified information on every container of hazardous chemicals.
- Occupier to submit an up-to-date safety report at least ninety days before making any modification.
- Occupiers of new and existing industrial activities to carry out safety audit and submit report within 30 days.
- Occupier to submit a safety audit update report once a year and forwarding a copy within 30 days.
- Occupier to prepare up-to-date on-site emergency plan before commencing a new industrial activity involving specified chemicals.
- Occupier shall conduct a mock drill of emergency plan every six months and submit a report.
- Occupier to maintain records of imports of hazardous chemicals and to provide information to the concerned Authority.
- Occupier to ensure the transportation of hazardous chemicals as per the
- provisions of the Motor Vehicles Act, 1988.

***The Public Liability Insurance Act, 1991***

- Owner to provide relief in case of death or injury or damage to property from an accident on the principle of no fault.
- Owner to draw insurance policies more than the paid-up capital but less than
- Rs. 50 Crores.
- 'Paid-up Capital' is the market value of all assets and stocks on the date of insurance.

- Owner to pay additional amounts as contribution to the 'Environmental Relief Fund'.
- Owner to provide any information required for ascertaining compliance with the provisions of the Act .
- Owner to allow entry and inspection to ascertain compliance with the provisions of the Act.
- Owner to pay the amount of an awarad as specified by the Collector.
- Comply with the directions issued in writing by the Central Government, directions may include ;
  i) prohibition or regulations of handling of any hazardous substances, or
  ii) stoppage or regulation of the supply of electricity, water or any other service.

**Environmental Clearance**

Grant of Environmental Clearance (1994)

If the industrial unit comes under the specified project, then environmental clearance would be required from he Ministry of Environment and Forests for new projects as well as for Expnsion / modernisation of Existing projects if pollution load is increasing.

Public Hearing (1997)

***Who Requires Environmental Clearance?***

The following project categories are required to obtain environmental clearance

- *New Projects*
- If investment is more than Rs. 100 crores
- Nuclear power plant and related projects, such as Heavy Water Plants, nuclear fuel complex, rare earths.
- River valley projects including hydro power, major irrigation projects and a combination, including flood control,
- Ports harbours, airports (except minor ports and harbours)
- Petroleum refineries including crude and product pipelines.
- Chemical fertilizers
- Exploration for oil and gas and their production transportation and storage
- Synthetic Rubber

- Primary metallurgical industaries ;
- Electric Arc Furnaces (Mini Steel Plants)
- Viscose staple fibre and filamentyarn
- Storage batteries integrated with the manufacture of oxides of lead and lead antimony alloy,
- Thermal power plants
- Pulp paper and newsprint
- Cement
- Any project proposed to be located within twenty five Km of
- Reserved forests
- Ecologically sensitive areas which may include National Parks, Sanctuaries,
- Biosphere Reserves,
- Critivally polluted areas
- Or within fifty kms of inter-state boundary shall require environmental clearance from the Central Government

**The following project categories, irrespective of the investment :**

- Pesticides
- Bulk drugs and pharmaceuticals
- Asbestos and asbestos products,
- All tourism projects between 200 – 500 meters of a High Tide Line and at locations with an elevation of more than 1,000 meters with investments of more than Rs. 5 crores.
- Mining projects (with leases of more than 5 hectares)
- Foundries
- Chlor-alkali industry
- Hydrocyanic Acid
- Electroplating
- Meta amine phenol
- Small scale industrial units in project categories mentioned above.

- With investments less than Rs. 1 crore and Which are on the reserved list Are exempted from environmental clearance

For obtaining site clearance, application is to be submitted giving the location of the project along with requisite details, to the Ministry of Environment and Forests. The Ministry of Environment and Forests will convey its decision about the suitability of the proposed site within a maximum period of 30 days.

**Environmental Clearance**

Last Opportunity by MoEF for the defaulting project proponents. To seek environment Clearance by 31st March, 2003. Environmental Clearance can be taken for industrial estates.

**The National Environment Tribunal Act, 1995**

To provide for strict liability for damages arising out of any acciadent occuring while handling any hazardous substance. To establish a National Environment Tribunal fr grating relief and compensation. The Tribunal may if it thinks fit take up cases for claims for compensation suo moto (on its own). A claimant making an application may also make an application for immediate relief under the Public Liability Insurance Act.

**Bio-medical Waste (Management & Handling) Rules, 1998.**

Proper segregation of wastes & Labeling as specified Install Pollution Control Systems Like Incinerators, autoclaves or microwaves aor adopt dee burial and meet the prescribed limits of emisionsComply with the dead-line stipulated to install the pollution control systems. Transportation of waste as per the norms.

**Regulation on Recycling of Waste Materials, 1999, 2000**

**The waste materials targeted :** waste oils, lead – acid batteries, non-ferrous wastes The auction / sale of these materials to only authorised recyclers who are registered with the Ministry of Environment & Forests, Govt of India. No trader can take such type of waste.

**Noise Pollution (Regulation & Control) Rules, 2000**

Aiming to regulate and control noise from sources like, industrial activity. construction activity, generator sets, loud speakers, public address systems, music systems, vehicular horns and other mechanical devices.

The prescribed Ambient Noise Levels are to be complied with A loud speaker should not be used except after obtaining written permission from the authority If the noise level exceeds the ambient standards by 10d(B) A, complaint can be lodged to the authority.

**Batteries (M & H) Rules, 2001**

Responsibilities for Manufacturers, users auctioners, dealers and importers of batteries Manufactures are to take initiatives to collect the spent batteries back Recyclers / re-processors of batteries need to register themselves with the MoEF

**Procedural Requirements to Operate an Industry**

Seek from SPCB the Consent to Establish and Consent to Operate under Water and Air Acts and apply for their renewal Submit to the SPCB Water Cess Return as per the periodicity given Comply with the effluent / emission standards for source or General Standards as per the E(P) Act Seek from SPCB an 'autorisation' under the HW under the HW (M & H) Rules and apply for its renewal Maintain the records of the hazardous Waste produced Seek Environmental Clearance for the specified project Submit Environmental Statement every year For the chemicals handled, check under which Schedule of MSIHC, Rules it is covered Follow the requirements given in the MSIHC, Rules Provide the workers with information, training & equipment Inform the major accidents to the prescribed authority Notification of Site & Submit Safety Report if applicable Prepare on-site emergency plan

**Undertake mock audits**

Submit 'Safety Audit Report' to the Prescribed Authority Leveling, packaging and transportation of hazardous chemicals according to Motor Vehicle Act / Rules The Indian Boiles Act 1923 & Rules 1961 The Indian Electricity Act 1910 & Rules 1956

The Explosives act, Gas Cylinder Rules 1981

The Pressure Vessels Act, Rules, 1981

POST GRADUATE PROGRAMME
M.A. (PREVIOUS) ECONOMICS

# Paper - IV (A)
# M.A. (PREVIOUS) ECONOMICS

## DISTANCE EDUCATION
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## BLOCK : II


Unit 1 . Management of natural resources
Unit 2 Sustainable development and environment
Unit 3 Macro economic policies and environment



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DISTANCE EDUCATION
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| Unit 1 | Management of natural resources |
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PAPER - IV (A) M.A. (PREVIOUS) ECONOMICS

# BLOCK - II

# BLOCK 2 ECONOMICS OF NATURAL RESOURCE MANAGEMENT AND SUSTAINABLE DEVELOPMENT

The aim of this block is to present certain theories and approaches to natural resource management and sustainable development which is an important area of concern for decision makers in the area of environmental economics.

First unit deals the basic concepts of management of natural resources. It focuses on Management of renewable resources; Renewable energy commercialisation and theories and approaches pertaining to non renewable or exhaustible resources

Unit 2 discusses propositions to sustainable development and environment. Unit throws light on scope and definitions of sustainable development; Sustainable development in economics; Sustainable development in India and tradeoffs between environment and development

Unit 3 presents to you the macro economic policies and environment. Fundamental issues of macroeconomics and sustainability are discussed followed by revised microeconomic theory and policy for the 21st century. Concepts related to environmental and economic accounting are explained in detailed along with the discussion on environmentally corrected GDP.

# UNIT 1

# MANAGEMENT OF NATURAL RESOURCES

**Objectives**

***After studying this unit you should be able to:***

- *Define the approach to management of renewable and exhaustible resources*
- *Understand the commercialization of renewable energy*
- *Know the concepts and theories related to non renewable and exhaustible resources.*

**Structure**

1.1 Introduction

1.2 Management of renewable resources

1.3 Renewable energy commercialisation

1.4 Non renewable or exhaustible resources

1.5 Summary

1.6 Further readings

## 1.1 INTRODUCTION

Natural resource management refers to the management of natural resources such as land, water, soil, plants and animals, with a particular focus on how management affects the quality of life for both present and future generations. Natural resource management is congruent with the concept of sustainable development, a scientific principle that forms a basis for sustainable global land management and environmental governance to conserve and preserve natural resources.

Natural resource management specifically focuses on a scientific and technical understanding of resources and ecology and the life-supporting capacity of those resources. The term Environmental management is also similar to natural resource management. The Natural resource management emphasis on sustainability can be traced back to early attempts to understand the ecological nature of American rangelands in the late 19th century, and the resource conservation movement of the same time. This type of analysis coalesced in the 20th century, and took on a more holistic, national and even global form, culminating in the Brundtland Commission and the advocacy of sustainable development. Eco-tourism to some extent can be utilized as a tool for natural resource management. In this unit emphasis is on economics of natural resource management and concepts related to sustainable development.

## 1.2 MANAGEMENT OF RENEWABLE RESOURCES

A natural resource is a renewable resource if it is replaced by natural processes at a rate comparable or faster than its rate of consumption by humans. Solar radiation, tides, winds and hydroelectricity are perpetual resources that are in no danger of a lack of long-term availability. Renewable resources may also mean commodities such as wood, paper, and leather, if harvesting is performed in a sustainable manner.

Some natural renewable resources such as geothermal power, fresh water, timber, and biomass must be carefully managed to avoid exceeding the world's capacity to replenish them. A life cycle assessment provides a systematic means of evaluating renewability.

The term has a connotation of sustainability of the natural environment. Gasoline, coal, natural gas, diesel, and other commodities derived from fossil fuels are non-renewable. Unlike fossil fuels, a renewable resource can have a sustainable yield.

In order to optimize renewable resources in the best possible way they are used to generate renewable energy. Renewable energy is energy generated from natural resources—such as sunlight, wind, rain, tides, and geothermal heat—which are renewable (naturally replenished). In 2006, about 18% of global final energy consumption came from renewables, with 13% coming from traditional biomass, such as wood-burning.

Hydroelectricity was the next largest renewable source, providing 3% of global energy consumption and 15% of global electricity generation.

Wind power is growing at the rate of 30 percent annually, with a worldwide installed capacity of 121,000 megawatts (MW) in 2008, and is widely used in European countries and the United States. The annual manufacturing output of the photovoltaics industry reached 6,900 MW in 2008, and photovoltaic (PV) power stations are popular in Germany and Spain. Solar thermal power stations operate in the USA and Spain, and the largest of these is the 354 MW SEGS power plant in the Mojave Desert.

The world's largest geothermal power installation is The Geysers in California, with a rated capacity of 750 MW. Brazil has one of the largest renewable energy programs in the world, involving production of ethanol fuel from sugar cane, and ethanol now provides 18 percent of the country's automotive fuel. Ethanol fuel is also widely available in the USA.

While most renewable energy projects and production is large-scale, renewable technologies are also suited to small off-grid applications, sometimes in rural and remote areas, where energy is often crucial in human development. Kenya has the world's highest household solar ownership rate with roughly 30,000 small (20–100 watt) solar power systems sold per year. Some renewable-energy technologies are criticized for being intermittent or unsightly, yet the renewable-energy market continues to grow. Climate-change concerns, coupled with high oil prices, peak oil, and increasing government support, are driving increasing renewable-energy legislation, incentives and commercialization. New government spending, regulation and policies should help the industry weather the 2009 economic crisis better than many other sectors.

## Main forms/sources of renewable energy

The majority of renewable energy technologies are powered by the sun. The Earth-Atmosphere system is in equilibrium such that heat radiation into space is equal to incoming solar radiation, the resulting level of energy within the Earth-Atmosphere system can roughly be described as the Earth's "climate." The hydrosphere (water) absorbs a major fraction of the incoming radiation. Most radiation is absorbed at low

latitudes around the equator, but this energy is dissipated around the globe in the form of winds and ocean currents. Wave motion may play a role in the process of transferring mechanical energy between the atmosphere and the ocean through wind stress. Solar energy is also responsible for the distribution of precipitation which is tapped by hydroelectric projects, and for the growth of plants used to create biofuels.

Renewable energy flows involve natural phenomena such as sunlight, wind, tides and geothermal heat, as the International Energy Agency explains:

Renewable energy is derived from natural processes that are replenished constantly. In its various forms, it derives directly from the sun, or from heat generated deep within the earth. Included in the definition is electricity and heat generated from solar, wind, ocean, hydropower, biomass, geothermal resources, and biofuels and hydrogen derived from renewable resources. Each of these sources has unique characteristics which influence how and where they are used.

## Wind power

Airflows can be used to run wind turbines. Modern wind turbines range from around 600 kW to 5 MW of rated power, although turbines with rated output of 1.5–3 MW have become the most common for commercial use; the power output of a turbine is a function of the cube of the wind speed, so as wind speed increases, power output increases dramatically. Areas where winds are stronger and more constant, such as offshore and high altitude sites are preferred locations for wind farms. Typical capacity factors are 20-40%, with values at the upper end of the range in particularly favourable sites.

Globally, the long-term technical potential of wind energy is believed to be five times total current global energy production, or 40 times current electricity demand. This could require large amounts of land to be used for wind turbines, particularly in areas of higher wind resources. Offshore resources experience mean wind speeds of ~90% greater than that of land, so offshore resources could contribute substantially more energy. This number could also increase with higher altitude ground-based or airborne wind turbines.

Wind power is renewable and produces no greenhouse gases during operation, such as carbon dioxide and methane.

## Water power

Energy in water (in the form of kinetic energy, temperature differences or salinity gradients) can be harnessed and used. Since water is about 800 times denser than air, even a slow flowing stream of water, or moderate sea swell, can yield considerable amounts of energy.

There are many forms of water energy:

- Hydroelectric energy is a term usually reserved for large-scale hydroelectric dams. Examples are the Grand Coulee Dam in Washington State and the Akosombo Dam in Ghana.
- Micro hydro systems are hydroelectric power installations that typically produce up to 100 kW of power. They are often used in water rich areas as a Remote Area Power Supply (RAPS). There are many of these installations around the world, including several delivering around 50 kW in the Solomon Islands.
- Damless hydro systems derive kinetic energy from rivers and oceans without using a dam.
- Ocean energy describes all the technologies to harness energy from the ocean and the sea:
    - Marine current power. Similar to tidal stream power, uses the kinetic energy of marine currents
    - Ocean thermal energy conversion (OTEC) uses the temperature difference between the warmer surface of the ocean and the colder lower recesses. To this end, it employs a cyclic heat engine. OTEC has not been field-tested on a large scale.
    - Tidal power captures energy from the tides.

- Wave power uses the energy in waves. Wave power machines usually take the form of floating or neutrally buoyant structures which move relative to one another or to a fixed point.

- Osmotic power or salinity gradient power is the energy retrieved from the difference in the salt concentration between seawater and river water. Reverse electrodialysis (PRO) is in the research and testing phase.
- Vortex power is generated by placing obstacles in rivers in order to cause the formation of vortices which can then be tapped for energy.

### Solar energy

In this context, "solar energy" refers to energy that is collected from sunlight. Solar energy can be applied in many ways, including to:

- Generate electricity using photovoltaic solar cells.
- Generate electricity using concentrating solar power.
- Generate electricity by heating trapped air which rotates turbines in a Solar updraft tower.
- Generate hydrogen using photoelectrochemical cells.
- Heat water or air for domestic hot water and space heating needs using solar-thermal panels.
- Heat buildings, directly, through passive solar building design.
- Heat foodstuffs, through solar ovens.
- Solar air conditioning

## Biofuel

Plants use photosynthesis to grow and produce biomass. Also known as biomatter, biomass can be used directly as fuel or to produce biofuels.. Agriculturally produced biomass fuels, such as biodiesel, ethanol and bagasse (often a by-product of sugar cane cultivation) can be burned in internal combustion engines or boilers. Typically biofuel is burned to release its stored chemical energy. Research into more efficient

methods of converting biofuels and other fuels into electricity utilizing fuel cells is an area of very active work.

## Liquid biofuel

Liquid biofuel is usually either a bioalcohol such as ethanol fuel or oil such as biodiesel or straight vegetable oil. Biodiesel can be used in modern diesel vehicles with little or no modification to the engine. It can be made from waste and virgin vegetable and animal oils and fats (lipids). Virgin vegetable oils can be used in modified diesel engines. In fact the diesel engine was originally designed to run on vegetable oil rather than fossil fuel. A major benefit of biodiesel use is the reduction in net $CO_2$ emissions, since all the carbon emitted was recently captured during the growing phase of the biomass. The use of biodiesel also reduces emission of carbon monoxide and other pollutants by 20 to 40%.

In some areas corn, cornstalks, sugarbeets, sugar cane, and switchgrasses are grown specifically to produce ethanol (also known as grain alcohol) a liquid which can be used in internal combustion engines and fuel cells. Ethanol is being phased into the current energy infrastructure. E85 is a fuel composed of 85% ethanol and 15% gasoline that is sold to consumers. Biobutanol is being developed as an alternative to bioethanol. Another source of biofuel is sweet sorghum. It produces both food and fuel from the same crop. Some studies have shown that the crop is net energy positive ie. it produces more energy than is consumed in its production and utilization.

## Solid biomass

Solid biomass is most commonly used directly as a combustible fuel, producing 10-20 MJ/kg of heat. Its forms and sources include wood fuel, the biogenic portion of municipal solid waste, or the unused portion of field crops. Field crops may or may not be grown intentionally as an energy crop, and the remaining plant byproduct used as a fuel. Most types of biomass contain energy. Even cow manure still contains two-thirds of the original energy consumed by the cow. Energy harvesting via a bioreactor is a cost-effective solution to the waste disposal issues faced by the dairy farmer, and can produce enough biogas to run a farm.

With current technology, it is not ideally suited for use as a transportation fuel. Most transportation vehicles require power sources with high power density, such as that provided by internal combustion engines. These engines generally require clean burning fuels, which are generally in liquid form, and to a lesser extent, compressed gaseous phase. Liquids are more portable because they can have a high energy density, and they can be pumped, which makes handling easier.

Non-transportation applications can usually tolerate the low power-density of external combustion engines that can run directly on less-expensive solid biomass fuel, for combined heat and power. One type of biomass is wood, which has been used for millennia. Two billion people currently cook every day, and heat their homes in the winter by burning biomass, which is a major contributor to man-made climate change global warming. The black soot that is being carried from Asia to polar ice caps is causing them to melt faster in the summer. In the 19th century, wood-fired steam engines were common, contributing significantly to industrial revolution unhealthy air pollution. Coal is a form of biomass that has been compressed over millennia to produce a non-renewable, highly-polluting fossil fuel.

Wood and its byproducts can now be converted through processes such as gasification into biofuels such as woodgas, biogas, methanol or ethanol fuel; although further development may be required to make these methods affordable and practical. Sugar cane residue, wheat chaff, corn cobs and other plant matter can be, and are, burned quite successfully. The net carbon dioxide emissions that are added to the atmosphere by this process are only from the fossil fuel that was consumed to plant, fertilize, harvest and transport the biomass.

Processes to harvest biomass from short-rotation trees like poplars and willows and perennial grasses such as switchgrass, phalaris, and miscanthus, require less frequent cultivation and less nitrogen than do typical annual crops. Pelletizing miscanthus and burning it to generate electricity is being studied and may be economically viable.

## Biogas

Biogas can easily be produced from current waste streams, such as paper production, sugar production, sewage, animal waste and so forth. These various waste streams have to be slurried together and allowed to naturally ferment, producing methane gas. This can be done by converting current sewage plants into biogas plants. When a biogas plant has extracted all the methane it can, the remains are sometimes more suitable as fertilizer than the original biomass. Alternatively biogas can be produced via advanced waste processing systems such as mechanical biological treatment. These systems recover the recyclable elements of household waste and process the biodegradable fraction in anaerobic digesters.

Renewable natural gas is a biogas which has been upgraded to a quality similar to natural gas. By upgrading the quality to that of natural gas, it becomes possible to distribute the gas to the mass market via the existing gas grid.

## Geothermal energy

Geothermal energy is energy obtained by tapping the heat of the earth itself, both from kilometers deep into the Earth's crust in some places of the globe or from some meters in geothermal heat pump in all the places of the planet. It is expensive to build a power station but operating costs are low resulting in low energy costs for suitable sites. Ultimately, this energy derives from heat in the Earth's core.

Three types of power plants are used to generate power from geothermal energy: dry steam, flash, and binary. Dry steam plants take steam out of fractures in the ground and use it to directly drive a turbine that spins a generator. Flash plants take hot water, usually at temperatures over 200 °C, out of the ground, and allows it to boil as it rises to the surface then separates the steam phase in steam/water separators and then runs the steam through a turbine. In binary plants, the hot water flows through heat exchangers, boiling an organic fluid that spins the turbine. The condensed steam and remaining geothermal fluid from all three types of plants are injected back into the hot rock to pick up more heat.

The geothermal energy from the core of the Earth is closer to the surface in some areas than in others. Where hot underground steam or water can be tapped and brought to the surface it may be used to generate electricity. Such geothermal power sources exist in certain geologically unstable parts of the world such as Chile, Iceland, New Zealand, United States, the Philippines and Italy. The two most prominent areas for this in the United States are in the Yellowstone basin and in northern California. Iceland produced 170 MW geothermal powers and heated 86% of all houses in the year 2000 through geothermal energy. Some 8000 MW of capacity is operational in total.

There is also the potential to generate geothermal energy from hot dry rocks. Holes at least 3 km deep are drilled into the earth. Some of these holes pump water into the earth, while other holes pump hot water out. The heat resource consists of hot underground radiogenic granite rocks, which heat up when there is enough sediment between the rock and the earth's surface. Several companies in Australia are exploring this technology.

## 1.3 RENEWABLE ENERGY COMMERCIALIZATION

When comparing renewable energy sources with each other and with conventional power sources, three main factors must be considered:

- capital costs (including, for nuclear energy, waste-disposal and decommissioning costs);
- operating and maintenance costs;
- Fuel costs (for fossil-fuel and biomass sources—for wastes, these costs may actually be negative).

These costs are all brought together, using discounted cash flow, here. Inherently, renewables are on a decreasing cost curve, while non-renewables are on an increasing cost curve. In 2009, costs are comparable among wind, nuclear, coal, and natural gas, but for CSP—concentrating solar power—and PV (photovoltaics) they are somewhat higher. There are additional costs for renewables in terms of increased grid interconnection to allow for variability of weather and load, but these have been shown in the pan-European case to be quite low—overall, wind energy costs about the same as present-day power.

Wind power is growing at the rate of 30 percent annually, with a worldwide installed capacity of over 100 GW, and is widely used in several European countries and the United States. The manufacturing output of the photovoltaics industry reached more than 2,000 MW in 2006, and photovoltaic (PV) power stations are particularly popular in Germany and Spain. Solar thermal power stations operate in the USA and Spain, and the largest of these is the 354 MW SEGS power plant in the Mojave Desert.

The world's largest geothermal power installation is The Geysers in California, with a rated capacity of 750 MW. Brazil has one of the largest renewable energy programs in the world, involving production of ethanol fuel from sugar cane, and ethanol now provides 18 percent of the country's automotive fuel. Ethanol fuel is also widely available in the USA.

## Growth of renewables

From the end of 2004 to the end of 2008, solar photovoltaic (PV) capacity increased six fold to more than 16 gig watts (GW), wind power capacity increased 250 percent to 121 GW, and total power capacity from new renewable increased 75 percent to 280 GW. During the same period, solar heating capacity doubled to 145 gig watts-thermal (GWth), while bio diesel production increased six fold to 12 billion liters per year and ethanol production doubled to 67 billion liters per year.

| Selected renewable energy indicators | | | |
|---|---|---|---|
| **Selected global indicators** | **2006** | **2007** | **2008** |
| Investment in new renewable capacity (annual) | 63 | 104 | 120 billion USD |
| Existing renewables power capacity, including large-scale hydro | 1,020 | 1,070 | 1,140 GWe |
| Existing renewables power capacity, excluding large hydro | 207 | 240 | 280 GWe |
| Wind power capacity (existing) | 74 | 94 | 121 GWe |
| Biomass heating | | | ~250 GWth |
| Solar hot water/ Space heating | | | 145 GWth |

| | | | |
|---|---|---|---|
| Geothermal heating | | | ~50 GWth |
| Ethanol production (annual) | 39 | 50 | 67 billion liters |
| Countries with policy targets for renewable energy use | | 66 | 73 |

## Wind power market

At the end of 2008, worldwide wind farm capacity was 120,791 megawatts (MW), representing an increase of 28.8 percent during the year, and wind power produced some 1.3% of global electricity consumption. Wind power accounts for approximately 19% of electricity use in Denmark, 9% in Spain and Portugal, and 6% in Germany and the Republic of Ireland. The United States is an important growth area and installed U.S. wind power capacity reached 25,170 MW at the end of 2008. As of September 2009, the Roscoe Wind Farm (781 MW) is the world's largest wind farm.

In the UK, a licence to build the world's largest offshore windfarm, in the Thames estuary, has been granted. The London Array windfarm, 20 km off Kent and Essex, should eventually consist of 341 turbines, occupying an area of 230 km². This is a £1.5 billion, 1,000 megawatt project, which will power one-third of London homes. The windfarm will produce an amount of energy that, if generated by conventional means, would result in 1.9 million tonnes of carbon dioxide emissions every year. It could also make up to 10% of the Government's 2010 renewables target.

## New generation of solar thermal plants

Large solar thermal power stations include the 354 megawatt (MW) Solar Energy Generating Systems power plant in the USA, Nevada Solar One (USA, 64 MW), Andasol 1 (Spain, 50 MW), PS20 solar power tower (Spain, 20 MW), and the PS10 solar power tower (Spain, 11 MW).

The solar thermal power industry is growing rapidly with 1.2 GW under construction as of April 2009 and another 13.9 GW announced globally through 2014. Spain is the epicenter of solar thermal power development with 22 projects for 1,037 MW under construction, all of which are projected to come online by the end of 2010. In the United States, 5,600 MW of solar thermal power projects have been announced. In

developing countries, three World Bank projects for integrated solar thermal/combined-cycle gas-turbine power plants in Egypt, Mexico, and Morocco have been approved.

## World's largest photovoltaic power plants

As of January 2009, the largest photovoltaic (PV) power plants in the world are the Parque Fotovoltaico Olmedilla de Alarcon (Spain, 60 MW), the Moura photovoltaic power station (Portugal, 46 MW), and the Waldpolenz Solar Park (Germany, 40 MW). Several other PV power plants were completed in Spain in 2008: Planta Solar Arnedo (30 MW), Parque Solar Merida/Don Alvaro (30 MW), Planta solar Fuente Álamo (26 MW), Planta fotovoltaica de Lucainena de las Torres (23.2 MW), Parque Fotovoltaico Abertura Solar (23.1 MW), Parque Solar Hoya de Los Vincentes (23 MW), Huerta Solar Almaraz (22.1 MW), Solarpark Calveron (21 MW), and the Planta Solar La Magascona (20 MW).

Topaz Solar Farm is a proposed 550 MW solar photovoltaic power plant which is to be built northwest of California Valley in the USA at a cost of over $1 billion. Built on 9.5 square miles (25 km2) of ranchland, the project would utilize thin-film PV panels designed and manufactured by OptiSolar in Hayward and Sacramento. The project would deliver approximately 1,100 gigawatt-hours (GW·h) annually of renewable energy. The project is expected to begin construction in 2010, begin power delivery in 2011, and be fully operational by 2013.

High Plains Ranch is a proposed 250 MW solar photovoltaic power plant which is to be built by SunPower in the Carrizo Plain, northwest of California Valley.

However, when it comes to renewable energy systems and PV, it is not just large systems that matter. Building-integrated photovoltaics or "onsite" PV systems have the advantage of being matched to end use energy needs in terms of scale. So the energy is supplied close to where it is needed.

## Use of ethanol for transportation

Since the 1970s, Brazil has had an ethanol fuel program which has allowed the country to become the world's second largest producer of ethanol (after the United States) and the world's largest exporter. Brazil's ethanol fuel program uses modern equipment and cheap sugar cane as feedstock, and the residual cane-waste (bagasse) is used to

process heat and power. There are no longer light vehicles in Brazil running on pure gasoline. By the end of 2008 there were 35,000 filling stations throughout Brazil with at least one ethanol pump.

Most cars on the road today in the U.S. can run on blends of up to 10% ethanol, and motor vehicle manufacturers already produce vehicles designed to run on much higher ethanol blends. Ford, DaimlerChrysler, and GM are among the automobile companies that sell "flexible-fuel" cars, trucks, and minivans that can use gasoline and ethanol blends ranging from pure gasoline up to 85% ethanol (E85). By mid-2006, there were approximately six million E85-compatible vehicles on U.S. roads. The challenge is to expand the market for biofuels beyond the farm states where they have been most popular to date. Flex-fuel vehicles are assisting in this transition because they allow drivers to choose different fuels based on price and availability. The Energy Policy Act of 2005, which calls for 7.5 billion gallons of biofuels to be used annually by 2012, will also help to expand the market.

## Geothermal energy prospects

The Geysers, is a geothermal power field located 72 miles (116 km) north of San Francisco, California. It is the largest geothermal development in the world outputting over 750 MW.

By the end of 2005 worldwide use of geothermal energy for electricity had reached 9.3 GWs, with an additional 28 GW used directly for heating. If heat recovered by ground source heat pumps is included, the non-electric use of geothermal energy is estimated at more than 100 GWt (gigawatts of thermal power) and is used commercially in over 70 countries.( sec 1.2) During 2005 contracts were placed for an additional 0.5 GW of capacity in the United States, while there were also plants under construction in 11 other countries.

## Wave farms expansion

Portugal now has the world's first commercial wave farm, the Agucadoura Wave Park, officially opened in September 2008. The farm uses three Pelamis P-750 machines generating 2.25 MW. Initial costs are put at €8.5 million. A second phase of the project is

now planned to increase the installed capacity to 21MW using a further 25 Pelamis machines.

Funding for a wave farm in Scotland was announced in February, 2007 by the Scottish Government, at a cost of over 4 million pounds, as part of a £13 million funding packages for ocean power in Scotland. The farm will be the world's largest with a capacity of 3MW generated by four Pelamis machines.

## Developing country markets

Renewable energy can be particularly suitable for developing countries. In rural and remote areas, transmission and distribution of energy generated from fossil fuels can be difficult and expensive. Producing renewable energy locally can offer a viable alternative.

Renewable energy projects in many developing countries have demonstrated that renewable energy can directly contribute to poverty alleviation by providing the energy needed for creating businesses and employment. Renewable energy technologies can also make indirect contributions to alleviating poverty by providing energy for cooking, space heating, and lighting. Renewable energy can also contribute to education, by providing electricity to schools.

Kenya is the world leader in the number of solar power systems installed per capita (but not the number of watts added). More than 30,000 very small solar panels, each producing 12 to 30 watts, are sold in Kenya annually. For an investment of as little as $100 for the panel and wiring, the PV system can be used to charge a car battery, which can then provide power to run a fluorescent lamp or a small television for a few hours a day. More Kenyans adopt solar power every year than make connections to the country's electric grid.

## Potential future utilization

Sustainable development and global warming groups propose a 100% Renewable Energy Source Supply, without fossil fuels and nuclear power. Scientists from the University of Kassel have suggested that Germany can power itself entirely by renewable energy.

## Industry and policy trends

Many countries and states have implemented incentives — like government tax subsidies, partial co-payment schemes and various rebates over purchase of renewables — to encourage consumers to shift to renewable energy sources. Government grants fund for research in renewable technology to make the production cheaper and generation more efficient. While government incentives drive much of the renewable energy industry, according to the Environmental Law Institute, fossil fuel energy receives much more in subsidies than renewables in the US. The ELI states that fossil fuel industries received $72 billion in subsides and incentives compared to $29 billion for renewables.

Development of loan programs that stimulate renewable favoring market forces with attractive return rates, buffer initial deployment costs and entice consumers to consider and purchase renewable technology. A famous example is the solar loan program sponsored by UNEP helping 100,000 people finance solar power systems in India. Success in India's solar program has led to similar projects in other parts of developing world like Tunisia, Morocco, Indonesia and Mexico.

Imposition of fossil fuel consumption and carbon taxes, and channel the revenue earned towards renewable energy development.

Also oil peak and world petroleum crisis and inflation are helping to promote renewables.

Many think-tanks are warning that the world needs an urgency driven concerted effort to create a competitive renewable energy infrastructure and market. The developed world can make more research investments to find better cost efficient technologies, and manufacturing could be transferred to developing countries in order to use low labor costs. The renewable energy market could increase fast enough to replace and initiate the decline of fossil fuel dominance and the world could then avert the looming climate and peak oil crises.

Most importantly, renewables is gaining credence among private investors as having the potential to grow into the next big industry. Many companies and venture capitalists are investing in photovoltaic development and manufacturing. This trend is particularly visible in Silicon valley, California, Europe, Japan. Central to the discussion over what power sources are renewable are definitions in law, which may determine

whether certain projects are eligible for subsidies (or tax benefits). As a result, environmental groups and vested interests have done considerable lobbying and affected the definition of renewable or sustainable sources in legislation.

## Constraints and opportunities

### Availability and reliability

There is no shortage of solar-derived energy on Earth. Indeed the storages and flows of energy on the planet are very large relative to human needs.

- Annual photosynthesis by the vegetation in the United States is 50 billion GJ, equivalent to nearly 60% of the nation's annual fossil fuel use.
- The amount of solar energy intercepted by the Earth every minute is greater than the amount of energy the world uses in fossil fuels each year.
- The energy in the winds that blow across the United States each year could produce more than 16 billion GJ of electricity—more than one and one-half times the electricity consumed in the United States in 2000.
- Tropical oceans absorb 560 trillion gigajoules (GJ) of solar energy each year, equivalent to 1,600 times the world's annual energy use.

A criticism of some renewable sources is their variable nature. But renewable power sources can actually be integrated into the grid system quite well, as Amory Lovins explains:

Variable but forecastable renewables (wind and solar cells) are very reliable when integrated with each other, existing supplies and demand. For example, three German states were more than 30 percent wind-powered in 2007—and more than 100 percent in some months. Mostly renewable power generally needs less backup than utilities already bought to combat big coal and nuclear plants' intermittence.

The challenge of variable power supply may be readily alleviated by grid energy storage. Available storage options include pumped-storage hydro systems, batteries, hydrogen fuel cells, thermal mass and compressed air. Initial investments in such energy storage systems may be high, although the costs can be recovered over the life of the system.

Lovins goes on to say that the unreliability of renewable energy is a myth, while the unreliability of nuclear energy is real. Of all U.S. nuclear plants built, 21 percent were

abandoned and 27 percent have failed at least once. Successful reactors must close for refueling every 17 months for 39 days. And when shut in response to grid failure, they can't quickly restart. This is simply not the case for wind farms, for example.

Wave energy and some other renewables are continuously available. A wave energy scheme installed in Australia generates electricity with an 80% availability factor.

## Environmental, social and legal considerations

While most renewable energy sources do not produce pollution directly, the materials, industrial processes, and construction equipment used to create them may generate waste and pollution. Some renewable energy systems actually create environmental problems.

## Land area required

Another environmental issue, particularly with biomass and biofuels, is the large amount of land required to harvest energy, which otherwise could be used for other purposes or left as undeveloped land. However, it should be pointed out that these fuels may reduce the need for harvesting non-renewable energy sources, such as vast strip-mined areas and Slag Mountains for coal, safety zones around nuclear plants, and hundreds of square miles being strip-mined for oil sands. These responses, however, do not account for the extremely high biodiversity and endemism of land used for ethanol crops, particularly sugar cane.

In the U.S., crops grown for biofuels are the most land- and water-intensive of the renewable energy sources. In 2005, about 12% of the nation's corn crop (covering 11 million acres (45,000 km²) of farmland) was used to produce four billion gallons of ethanol—which equates to about 2% of annual U.S. gasoline consumption. For biofuels to make a much larger contribution to the energy economy, the industry will have to accelerate the development of new feedstocks, agricultural practices, and technologies that are more land and water efficient.

The efficiency of biofuels production has increased significantly and there are new methods to boost biofuel production, although using bioelectricity, by burning the biomass to produce electricity for an electric car, increases the distance that a car can go from a hectare (about 2.5 acres) of crops by 81%, from 30,000 km to 54,000 km per year. However, covering that same hectare with photovoltaics (in relatively sunless Germany

or England) allows the electric car to go 3,250,000 km/year, over 100 times as far as from biofuel.

## Hydroelectricity

The major advantage of hydroelectric systems is the elimination of the cost of fuel. Other advantages include longer life than fuel-fired generation, low operating costs, and the provision of facilities for water sports. Operation of pumped-storage plants improves the daily load factor of the generation system. Overall, hydroelectric power can be far less expensive than electricity generated from fossil fuels or nuclear energy, and areas with abundant hydroelectric power attract industry.

However, there are several major disadvantages of hydroelectric systems. These include: dislocation of people living where the reservoirs are planned, release of significant amounts of carbon dioxide at construction and flooding of the reservoir, disruption of aquatic ecosystems and birdlife, adverse impacts on the river environment, potential risks of sabotage and terrorism, and in rare cases catastrophic failure of the dam wall.

Large hydroelectric power is considered to be a renewable energy by a large number of sources, however, many groups have lobbied for it to be excluded from *renewable electricity standards*, any initiative to promote the use of renewable energies, and sometimes the definition of renewable itself. Some organizations, including US federal agencies, will specifically refer to "non-hydro renewable energy". Many laws exist that specifically label "small hydro" as renewable or sustainable and large hydro as not. Furthermore, the line between what is small or large also differs by governing body.

Hydroelectric power is now more difficult to site in developed nations because most major sites within these nations are either already being exploited or may be unavailable for other reasons such as environmental considerations.

## Wind farms

A wind farm, when installed on agricultural land, has one of the lowest environmental impacts of all energy sources. To generate the total electricity used in the UK annually, 6% of the land area would be utilised, an area of about 70 miles by 70 miles, and this would not preclude that land from being used for other purposes.

- Wind power occupies less land area per kilowatt-hour (kWh) of electricity generated than any other energy conversion system, apart from rooftop solar energy, and is compatible with grazing and crops.
- It generates the energy used in its construction in just 3 months of operation, yet its operational lifetime is 20–25 years.
- Greenhouse gas emissions and air pollution produced by its construction are low and declining. There are no emissions or pollution produced by its operation.
- In substituting for base-load coal power, wind power produces a net decrease in greenhouse gas emissions and air pollution, and a net increase in biodiversity.
- Modern wind turbines are almost silent and rotate so slowly (in terms of revolutions per minute) that they are rarely a hazard to birds.

Studies of birds and offshore wind farms in Europe have found that there are very few bird collisions. Several offshore wind sites in Europe have been in areas heavily used by seabirds. Improvements in wind turbine design, including a much slower rate of rotation of the blades and a smooth tower base instead of perchable lattice towers, have helped reduce bird mortality at wind farms around the world. However older smaller wind turbines may be hazardous to flying birds. Birds are severely impacted by fossil fuel energy; examples include birds dying from exposure to oil spills, habitat loss from acid rain and mountaintop removal coal mining, and mercury poisoning.

## Longevity issues

Though a source of renewable energy may last for billions of years, renewable energy infrastructure, like hydroelectric dams, will not last forever, and must be removed and replaced at some point. Events like the shifting of riverbeds, or changing weather patterns could potentially alter or even halt the function of hydroelectric dams, lowering the amount of time they are available to generate electricity.

Some have claimed that geothermal being a renewable energy source depends on the rate of extraction being slow enough such that depletion does not occur. If depletion does occur, the temperature can regenerate if given a long period of non-use.

The government of Iceland states: "It should be stressed that the geothermal resource is not strictly renewable in the same sense as the hydro resource." It estimates that Iceland's geothermal energy could provide 1700 MW for over 100 years, compared

to the current production of 140 MW. Radioactive elements in the Earth's crust continuously decay, replenishing the heat. The International Energy Agency classifies geothermal power as renewable.

## Biofuels production

All biomass needs to go through some of these steps: it needs to be grown, collected, dried, fermented and burned. All of these steps require resources and an infrastructure.

Some studies contend that ethanol is "energy negative", meaning that it takes more energy to produce than is contained in the final product. However, a large number of recent studies, including a 2006 article in the journal *Science* offer the opinion that fuels like ethanol are energy positive. Furthermore, fossil fuels also require significant energy inputs which have seldom been accounted for in the past.

Additionally, ethanol is not the only product created during production, and the energy content of the by-products must also be considered. Corn is typically 66% starch and the remaining 33% is not fermented. This unfermented component is called distillers grain, which is high in fats and proteins, and makes good animal feed. In Brazil, where sugar cane is used, the yield is higher, and conversion to ethanol is somewhat more energy efficient than corn. Recent developments with cellulosic ethanol production may improve yields even further.

According to the International Energy Agency, new biofuels technologies being developed today, notably cellulosic ethanol, could allow biofuels to play a much bigger role in the future than previously thought. Cellulosic ethanol can be made from plant matter composed primarily of inedible cellulose fibers that form the stems and branches of most plants. Crop residues (such as corn stalks, wheat straw and rice straw), wood waste, and municipal solid waste are potential sources of cellulosic biomass. Dedicated energy crops, such as switchgrass, are also promising cellulose sources that can be sustainably produced in many regions of the United States.

The ethanol and biodiesel production industries also create jobs in plant construction, operations, and maintenance, mostly in rural communities. According to the Renewable Fuels Association, the ethanol industry created almost 154,000 U.S. jobs in

2005 alone, boosting household income by $5.7 billion. It also contributed about $3.5 billion in tax revenues at the local, state, and federal levels.

## Diversification

The U.S. electric power industry now relies on large, central power stations, including coal, natural gas, nuclear, and hydropower plants that together generate more than 95% of the nation's electricity. Over the next few decades uses of renewable energy could help to diversify the nation's bulk power supply. Already, appropriate renewable resources (which exclude large hydropower) produce 12% of northern California's electricity.

Although most of today's electricity comes from large, central-station power plants, new technologies offer a range of options for generating electricity nearer to where it is needed, saving on the cost of transmitting and distributing power and improving the overall efficiency and reliability of the system.

Improving energy efficiency represents the most immediate and often the most cost-effective way to reduce oil dependence, improve energy security, and reduce the health and environmental impact of the energy system. By reducing the total energy requirements of the economy, improved energy efficiency could make increased reliance on renewable energy sources more practical and affordable.

## Competition with nuclear power

Nuclear power continues to be considered as an alternative to fossil-fuel power sources (see Low carbon power generation), and in 1956, when the first peak oil paper was presented, nuclear was presented as the replacement for fossil fuel. However, that prospect effectively ended in the United States with Three Mile Island, and in the rest of the world with Chernobyl. Only France developed any significant use of nuclear power, reaching almost 80% uses in 2004.

Physicist Bernard Cohen proposed in 1983 that uranium is effectively inexhaustible, and could therefore be considered a renewable source of energy. However, this claim has not been proven, and issues such as peak uranium and uranium depletion are ongoing debates. No legislative body has yet included nuclear energy under any legal definition of "renewable energy sources" for provision of development support, and

statutory and scientific definitions of renewable energies normally exclude nuclear energy.

## 1.4 NON-RENEWABLE OR EXHAUSTIBLE RESOURCES

A non-renewable resource is a natural resource that cannot be produced, re-grown, regenerated, or reused on a scale which can sustain its consumption rate. These resources often exist in a fixed amount, or are consumed much faster than nature can recreate them. Fossil fuel (such as coal, petroleum and natural gas) and nuclear power are examples. In contrast, resources such as timber (when harvested sustainably) or metals (which can be recycled) are considered renewable resources.

### *Fossil fuels*

Natural resources such as coal, petroleum, oil and natural gas take thousands of years to form naturally and cannot be replaced as fast as they are being consumed. Eventually natural resources will become too costly to harvest and humanity will need to find other sources of energy. At present, the main energy sources used by humans are non-renewable as they are cheap to produce.

Some natural resources, called renewable resources, are replaced by natural processes given a reasonable amount of time. Soil, water, forests, plants, and animals are all renewable resources as long as they are properly conserved. Solar, wind, wave, and geothermal energies are based on renewable resources. Renewable resources such as the movement of water (hydropower, including tidal power; ocean surface waves used for wave power), wind (used for wind power), geothermal heat (used for geothermal power); and radiant energy (used for solar power) are practically infinite and cannot be depleted, unlike their non-renewable counterparts, which are likely to run out if not used wisely. Still, these technologies are not fully utilized.

### *Economic models*

Hotelling's rule is a 1931 economic model of non-renewable resource management by Harold Hotelling. It shows that efficient exploitation of a nonrenewable and non augmentable resource would, under otherwise stable economic conditions, lead to a depletion of the resource. The rule states that this would lead to a net price or "Hotelling rent" for it that rose annually at a rate equal to the rate of interest, reflecting

the increasing scarcity of the resources. The Hartwick's rule provides an important result about the sustainability of welfare in an economy that uses non-renewable resources.

### 1.4.1 Nonrenewable resources system

The nonrenewable resource system starts with the assumption that the total amount of resources available is finite (about 110 times the consumption at 1990s rates for the world3/91 model). These resources can be extracted and then used for various purposes in other systems in the model. An important assumption that was made is that as the nonrenewable resources are extracted, the remaining resources are increasingly difficult to extract, thus diverting more and more industrial output to resource extraction.

### 1.4.2 Low-carbon economy

A Low-Carbon Economy (LCE) or Low-Fossil-Fuel Economy. (LFFE) is a concept that refers to an economy which has a minimal output of greenhouse gas (GHG) emissions into the biosphere, but specifically refers to the greenhouse gas carbon dioxide. Recently, most of scientific and public opinion has come to the conclusion there is such an accumulation of GHGs (especially $CO_2$) in the atmosphere due to anthropogenic causes, that the climate is changing. The over-concentrations of these gases are producing global warming that affects long-term climate, with negative impacts on humanity in the foreseeable future. Globally implemented LCE's therefore, are proposed as a means to avoid catastrophic climate change, and as a precursor to the more advanced, zero-carbon society and renewable-energy economy.

Some nations are low carbon - societies which are not heavily industrialised or populated. In order to avoid climate change at any point in the future, all nations considered carbon intensive societies and societies which are heavily populated, should become zero-carbon societies and economies. Several of these countries have pledged to become 'low carbon' but not entirely zero carbon, and claim that emissions will be cut by 100% by offsetting emissions rather than ceasing all emissions - carbon neutrality. In other words, some emitting will continue which will be *offset* (so,the are not low-emission) .

Nations seek to become low-carbon economies as a part of a national global warming mitigation strategy. A comprehensive strategy to manage global warming is carbon neutrality, geo engineering and adaptation to global warming.

Nuclear power, or, the proposed strategies of carbon capture and storage (CCS) have been proposed as the primary means to achieve a LCE while continuing to exploit non-renewable resources; there is concern, however, with the matter of spent-nuclear-fuel storage, security and the uncertainty of costs and time needed to successfully implement CCS worldwide and with guarantees that the stored emissions will not leak into the biosphere. Alternatively, many have proposed renewable energy should be the main basis of a LCE, but, they have their associated problems of high-cost and inefficiency; this is changing, however, since investment and production have been growing.significantly in recent times. Furthermore, regardless of the effect to the biosphere by GHG emissions, the growing issue of peak oil may also be reason enough for a transition to an LCE.

The aim of a LCE is to integrate all aspects of itself from its manufacturing, agriculture, transportation and power-generation etc. around technologies that produce energy and materials with little GHG emission; and thus, around populations, buildings, machines and devices which use those energies and materials efficiently, and, dispose of or recycle its wastes so as to have a minimal output of GHGs. Furthermore, it has been proposed that to make the transition to an LCE economically viable we would have to attribute a cost(per unit output) to GHGs through means such as emissions trading and/or a carbon tax.

### 1.4.3 Hubbert peak theory

The Hubbert peak theory posits that for any given geographical area, from an individual oil-producing region to the planet as a whole, the rate of petroleum production tends to follow a bell-shaped curve. It is one of the primary theories on peak oil.

Choosing a particular curve determines a point of maximum production based on discovery rates, production rates and cumulative production. Early in the curve (pre-peak), the production rate increases because of the discovery rate and the addition of infrastructure. Late in the curve (post-peak), production declines because of resource depletion.

The Hubbert peak theory is based on the observation that the amount of oil under the ground in any region is finite; therefore the rate of discovery which initially increases quickly must reach a maximum and decline. In the US, oil extraction followed the discovery curve after a time lag of 32 to 35 years. The theory is named after American

geophysicist M. King Hubbert, who created a method of modeling the production curve given an assumed ultimate recovery volume.

"Hubbert's peak" can refer to the peaking of production of a particular area, which has now been observed for many fields and regions.

Hubbert's Peak was achieved in the continental US in the early 1970s. Oil production peaked at 10.2 million barrels a day. Since then, it has been in a gradual decline.

Peak oil as a proper noun or "Hubbert's peak" applied more generally, refers to a singular event in history: the peak of the entire planet's oil production. After Peak Oil, according to the Hubbert Peak Theory, the rate of oil production on Earth would enter a terminal decline. On the basis of his theory, in a paper he presented to the American Petroleum Institute in 1956, Hubbert correctly predicted that production of oil from conventional sources would peak in the continental United States around 1965-1970. Hubbert further predicted a worldwide peak at "about half a century" from publication and approximately 12 gig barrels (GB) a year in magnitude. In a 1976 TV interview Hubbert added that the actions of OPEC might flatten the global production curve but this would only delay the peak for perhaps 10 years.

**Activity 1**

1. What do you understand by renewable resources? discuss various uses of renewable resources.
2. Explain the types of exhaustible resources. What steps do governments of different nations take to optimally use these resources?
3. What are main forms of renewable energy?
4. Write short notes on the following.

- Biofuels production
- Hubbert peak theory
- Low carbon economy

## 1.5 SUMMARY

Natural resources are undoubtedly the backbone of our civilization. In a broad sense, they refer to all the living and nonliving endowment of the earth. Some natural resource stocks are renewable by natural or artificial processes while others are non-renewable – an often-used dichotomy in classifying resources. After introducing the basic concepts behind natural resources the unit discussed how these resources are managed in order to provide optimum benefits. In later sections commercialization of renewable energy was explained. Finally concepts and theories related to exhaustible resources have been discussed in detail.

## 1.6 FURTHER READINGS


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# UNIT 2

# SUSTAINABLE DEVELOPMENT AND ENVIRONMENT

**Objectives**

*After studying this unit you should be able to:*

- *Understand the approach and scope of sustainable development.*
- *Know the relevance of sustainable development in economics*
- *Appreciate the initiatives of Indian government and corporate sector to maintain development through the sustainable development approach.*
- *Be aware about the trade off between environment and development..*

***Structure***

2.1 Introduction

2.2 Scope and definitions of sustainable development

2.3 Sustainable development in economics

2.4 Sustainable development in India

2.5 Environment vs. development

2.6 Summary

2.7 Further readings

## 2.1 INTRODUCTION

Sustainable development is a pattern of resource use that aims to meet human needs while preserving the environment so that these needs can be met not only in the present, but also for future generations. The term was used by the Brundtland Commission which coined what has become the most often-quoted definition of sustainable development as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs."

Sustainable development ties together concern for the carrying capacity of natural systems with the social challenges facing humanity. As early as the 1970s "sustainability" was employed to describe an economy "in equilibrium with basic ecological support systems." Ecologists have pointed to the "limits of growth" and presented the alternative of a "steady state economy" in order to address environmental concerns.

The field of sustainable development can be conceptually broken into three constituent parts: environmental sustainability, economic sustainability and sociopolitical sustainability.

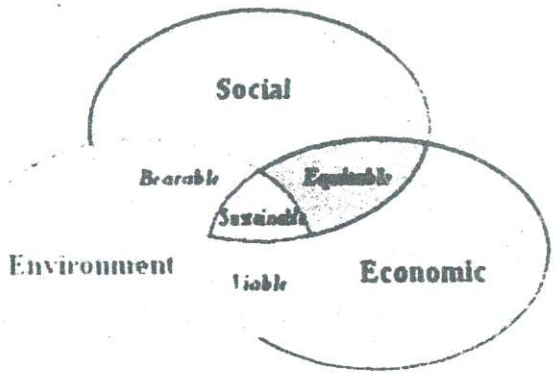


**Figure 1 Scheme of sustainable development: at the confluence of three constituent parts**

## 2.2 SCOPE AND DEFINITIONS OF SUSTAINABLE DEVELOPMENT

The concept has included notions of weak sustainability, strong sustainability and deep ecology. Sustainable development does not focus solely on environmental issues.

In 1987, the United Nations released the Brundtland Report, which defines sustainable development as 'development which meets the needs of the present without compromising the ability of future generations to meet their own needs.'

The United Nations 2005 World Summit Outcome Document refers to the "interdependent and mutually reinforcing pillars" of sustainable development as economic development, social development, and environmental protection.

Indigenous people have argued, through various international forums such as the United Nations Permanent Forum on Indigenous Issues and the Convention on Biological Diversity, that there are four pillars of sustainable development, the fourth being cultural. The Universal Declaration on Cultural Diversity (UNESCO, 2001) further elaborates the concept by stating that "...cultural diversity is as necessary for humankind as biodiversity is for nature"; it becomes "one of the roots of development understood not simply in terms of economic growth, but also as a means to achieve a more satisfactory intellectual,

emotional, moral and spiritual existence". In this vision, cultural diversity is the fourth policy area of sustainable development.

Economic Sustainability: Agenda 21 clearly identified information, integration, and participation as key building blocks to help countries achieve development that recognizes these interdependent pillars. It emphasises that in sustainable development everyone is a user and provider of information. It stresses the need to change from old sector-centered ways of doing business to new approaches that involve cross-sectoral co-ordination and the integration of environmental and social concerns into all development processes. Furthermore, Agenda 21 emphasises that broad public participation in decision making is a fundamental prerequisite for achieving sustainable development.

According to Hasna, sustainability is a process which tells of a development of all aspects of human life affecting sustenance. It means resolving the conflict between the various competing goals, and involves the simultaneous pursuit of economic prosperity, environmental quality and social equity famously known as three dimensions (triple bottom line) with is the resultant vector being technology, hence it is a continually evolving process; the 'journey' (the process of achieving sustainability) is of course vitally important, but only as a means of getting to the destination (the desired future state). However, the 'destination' of sustainability is not a fixed place in the normal sense that we understand destination. Instead, it is a set of wishful characteristics of a future system.

Green development is generally differentiated from sustainable development in that Green development prioritizes what its proponents consider to be environmental sustainability over economic and cultural considerations. Proponents of Sustainable Development argue that it provides a context in which to improve overall sustainability where cutting edge Green development is unattainable. For example, a cutting edge treatment plant with extremely high maintenance costs may not be sustainable in regions of the world with fewer financial resources. An environmentally ideal plant that is shut down due to bankruptcy is obviously less sustainable than one that is maintainable by the community, even if it is somewhat less effective from an environmental standpoint.

Some research activities start from this definition to argue that the environment is a combination of nature and culture. The Network of Excellence "Sustainable

Development in a Diverse World", sponsored by the European Union, integrates multidisciplinary capacities and interprets cultural diversity as a key element of a new strategy for sustainable development.

Still other researchers view environmental and social challenges as opportunities for development action. This is particularly true in the concept of sustainable enterprise that frames these global needs as opportunities for private enterprise to provide innovative and entrepreneurial solutions. This view is now being taught at many business schools including the Center for Sustainable Global Enterprise at Cornell University and the Erb Institute for Global Sustainable Enterprise at the University of Michigan.

The United Nations Division for Sustainable Development lists the following areas as coming within the scope of sustainable development:

Sustainable development is an eclectic concept, as a wide array of views fall under its umbrella. The concept has included notions of weak sustainability, strong sustainability and deep ecology. Different conceptions also reveal a strong tension between egocentrism and anthropocentrism. The concept remains weakly defined and contains a large amount of debate as to its precise definition.

During the last ten years, different organizations have tried to measure and monitor the proximity to what they consider sustainability by implementing what has been called sustainability metrics and indices. Sustainable development is said to set limits on the developing world. While current first world countries polluted significantly during their development, the same countries encourage third world countries to reduce pollution, which sometimes impedes growth. Some consider that the implementation of sustainable development would mean a reversion to pre-modern lifestyles.

**Others have criticized the overuse of the term:**

"[The] word sustainable has been used in too many situations today, and ecological sustainability is one of those terms that confuse a lot of people. You hear about sustainable development, sustainable growth, sustainable economies, sustainable societies, and sustainable agriculture. Everything is sustainable (Temple, 1992)."

## 2.3 SUSTAINABLE DEVELOPMENT IN ECONOMICS

The Venn diagram of sustainable development shown above has many versions, but was first used by economist Edward Barbier (1987). However, Pearce, Barbier and Markandya (1989) criticized the Venn approach due to the intractability of operationalizing separate indices of economic, environmental, and social sustainability and somehow combining them. They also noted that the Venn approach was inconsistent with the Brundtland Commission Report, which emphasized the interlinkages between economic development, environmental degradation, and population pressure instead of three objectives.

Economists have since focused on viewing the economy and the environment as a single interlinked system with a unified valuation methodology (Hamilton 1999, Dasgupta 2007). Intergenerational equity can be incorporated into this approach, as has become common in economic valuations of climate change economics (Heal,2009). Ruling out discrimination against future generations and allowing for the possibility of renewable alternatives to petro-chemicals and other non-renewable resources, efficient policies are compatible with increasing human welfare, eventually reaching a golden-rule steady state (Ayong le Kama, 2001 and Endress et al.2005) ). Thus the three pillars of sustainable development are interlinkages, intergenerational equity, and dynamic efficiency (Stavins, et al 2003).

### Environmental sustainability

Environmental sustainability is the process of making sure current processes of interaction with the environment are pursued with the idea of keeping the environment as pristine as naturally possible based on ideal-seeking behavior. .

An "unsustainable situation" occurs when natural capital (the sum total of nature's resources) is used up faster than it can be replenished. Sustainability requires that human activity only uses nature's resources at a rate at which they can be replenished naturally. Inherently the concept of sustainable development is intertwined with the concept of carrying capacity. Theoretically, the long-term result of environmental degradation is the inability to sustain human life. Such degradation on a global scale could imply extinction for humanity.

| Consumption of renewable resources | State of environment | Sustainability |
|---|---|---|
| More than nature's ability to replenish | Environmental degradation | Not sustainable |
| Equal to nature's ability to replenish | Environmental equilibrium | Steady-state economy |
| Less than nature's ability to replenish | Environmental renewal | Environmentally sustainable |

## The notion of capital in sustainable development

The sustainable development debate is based on the assumption that societies need to manage three types of capital (economic, social, and natural), which may be non-substitutable and whose consumption might be irreversible. Daly (1991), for example, points to the fact that natural capital can not necessarily be substituted by economic capital. While it is possible that we can find ways to replace some natural resources, it is much more unlikely that they will ever be able to replace eco-system services, such as the protection provided by the ozone layer, or the climate stabilizing function of the Amazonian forest. In fact natural capital, social capital and economic capital are often complementarities.

A further obstacle to substitutability lies also in the multi-functionality of many natural resources. Forests, for example, do not only provide the raw material for paper (which can be substituted quite easily), but they also maintain biodiversity, regulate water flow, and absorb CO2. Another problem of natural and social capital deterioration lies in their partial irreversibility. The loss in biodiversity, for example, is often definite. The same can be true for cultural diversity. For example with globalisation advancing quickly the number of indigenous languages is dropping at alarming rates. Moreover, the depletion of natural and social capital may have non-linear consequences.

Consumption of natural and social capital may have no observable impact until a certain threshold is reached. A lake can, for example, absorb nutrients for a long time

while actually increasing its productivity. However, once a certain level of algae is reached lack of oxygen causes the lake's ecosystem to break down all of a sudden.

## Market failure

If the degradation of natural and social capital has such important consequence the question arises why action is not taken more systematically to alleviate it. Cohen and Winn (2007) point to four types of market failure as possible explanations: First, while the benefits of natural or social capital depletion can usually be privatized the costs are often externalized (i.e. they are borne not by the party responsible but by society in general).

Second, natural capital is often undervalued by society since we are not fully aware of the real cost of the depletion of natural capital. Information asymmetry is a third reason--often the link between cause and effect is obscured, making it difficult for actors to make informed choices. Cohen and Winn close with the realization that contrary to economic theory many firms are not perfect optimizers. They postulate that firms often do not optimize resource allocation because they are caught in a "business as usual" mentality.

## The business case for sustainable development

The most broadly accepted criterion for corporate sustainability constitutes a firm's efficient use of natural capital. This eco-efficiency is usually calculated as the economic value added by a firm in relation to its aggregated ecological impact. This idea has been popularised by the World Business Council for Sustainable Development (WBCSD) under the following definition: "Eco-efficiency is achieved by the delivery of competitively-priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life-cycle to a level at least in line with the earth's carrying capacity." (DeSimone and Popoff, 1997: 47)

Similar to the eco-efficiency concept but so far less explored is the second criterion for corporate sustainability. Socio-efficiency describes the relation between a firm's value added and its social impact. Whereas, it can be assumed that most corporate impacts on the environment are negative (apart from rare exceptions such as the planting of trees) this is not true for social impacts. These can be either positive (e.g. corporate

giving, creation of employment) or negative (e.g. work accidents, mobbing of employees, human rights abuses). Depending on the type of impact socio-efficiency thus either tries to minimize negative social impacts (i.e. accidents per value added) or maximise positive social impacts (i.e. donations per value added) in relation to the value added.

Both eco-efficiency and socio-efficiency are concerned primarily with increasing economic sustainability. In this process they instrumentalize both natural and social capital aiming to benefit from win-win situations. However, as Dyllick and Hockerts point out the business case alone will not be sufficient to realise sustainable development. They point towards eco-effectiveness, socio-effectiveness, sufficiency, and eco-equity as four criteria that need to be met if sustainable development is to be reached.

## Critique of the concept of sustainable development

The concept of "Sustainable Development" raises several critiques at different levels.

### Purpose

Various writers have commented on the population control agenda that seems to underlie the concept of sustainable development. Maria Sophia Aguirre writes:

"Sustainable development is a policy approach that has gained quite a lot of popularity in recent years, especially in international circles. By attaching a specific interpretation to sustainability, population control policies have become the overriding approach to development, thus becoming the primary tool used to "promote" economic development in developing countries and to protect the environment."

Mary Jo Anderson suggests that the real purpose of sustainable development is to contain and limit economic development in developing countries, and in so doing control population growth. It is suggested that this is the reason the main focus of most programs is still on low-income agriculture. Joan Veon, a businesswoman and international reporter, who covered 64 global meetings on sustainable development, posits that:

"Sustainable development has continued to evolve as that of protecting the world's resources while its true agenda is to control the world's resources. It should be noted that Agenda 21 sets up the global infrastructure needed to manage, count, and control all of the world's assets."

**Consequences**

John Baden reckons that the notion of sustainable development is dangerous because the consequences are proceedings with unknown effects or potentially dangerous. He writes: "In economy like in ecology, the interdependence rules applies. Isolated actions are impossible. A policy which is not enough carefully thought will carry along various perverse and adverse effects for the ecology as much as for the economy. Many suggestions to save our environment and to promote a model of 'sustainable development' risk indeed leading to reverse effects." Moreover, he evokes the bounds of the public action which are underlined by the public choice theory: quest by the politics of their own interests, lobby pressure, partial disclosure etc. He develops his critique by noting the vagueness of the expression, which can cover anything:

"It is a gateway to interventionist proceedings which can be against the principle of freedom and without proven efficacy. Against this notion, he is a proponent of private property to impel the producers and the consumers to save the natural resources. According to Baden, "the improvement of environment quality depends on the market economy and the existence of legitimate and protected property rights." They enable the effective practice of personal responsibility and the development of mechanisms to protect the environment. The State can in this context "create conditions which encourage the people to save the environment."

**Vagueness of the term**

The term of "sustainable development" is criticized because of its vagueness. For example, Jean-Marc Jancovici or the philosopher Luc Ferry express this view. The latter writes about sustainable development: "I know that this term is obligatory, but I find it also absurd, or rather so vague that it says nothing." Luc Ferry adds that the term is trivial by a proof by contradiction: "who would like to be a proponent of an "untenable development! Of course no one. The term is more charming than meaningful. Everything must be done so that it does not turn into a Russian-type administrative planning with ill effects."

**Basis**

Sylvie Brunel, French geographer and specialist of the Third World, develops in A qui profite le développement durable (Who benefits from sustainable development?)

(2008) a critique of the basis of sustainable development, with its binary vision of the world, can be compared to the Christian vision of Good and Evil, a idealized nature where the human being is an animal like the others or even an alien. Nature – as Rousseau thought – is better than the human being. It is a parasite, harmful for the nature. But the human is the one who protects the biodiversity, where normally only the strong survive.

Moreover, she thinks that the ideas of sustainable development can hide a will to protectionism from the developed country to impede the development of the other countries. For Sylvie Brunel, the sustainable development serves as a pretext for the protectionism and "I have the feeling about sustainable development that it is perfectly helping out the capitalism".

**"De-growth"**

The proponents of the de-growth reckon that the term of sustainable development is an oxymoron. According to them, on a planet where 20% of the population consumes 80% of the natural resources, a sustainable development cannot be possible for this 20%: "According to the origin of the concept of sustainable development , a development which meets the needs of the present without compromising the ability of future generations to meet their own needs, the right term for the developed countries should be a sustainable de-growth".

Arrow et al. (2004) and other economists (e.g. Asheim,1999 and Pezzey, 1989 and 1997) have advocated a form of the weak criterion for sustainable development – the requirement than the wealth of a society, including human-capital, knowledge-capital and natural-capital (as well as produced capital) not decline over time. Others, including Barbier 2007, continue to contend that strong sustainability – non-depletion of essential forms of natural capital – may be appropriate.

## 2.4 SUSTAINABLE DEVELOPMENT IN INDIA

Sustainable development in India now encompasses a variety of development schemes in social, cleantech (clean energy, clean water and sustainable agriculture) and human resources segments, having caught the attention of both central and state governments and also public and private sectors. Social sector, cleantech investments into

green energy and fuel alternatives and development schemes for backward and below the poverty line (BPL) families are being touted as some of the more heavily invested segments in India in 2009, despite the economic slowdown.

In fact, India is expected to begin the greening of its national income accounting starting next year, making depletion in natural resources wealth a key component in its measurement of gross domestic product (GDP).

The Ministry of Statistics and Programme Implementation is now readying a national database to calculate the cost of depletion of natural resources in the process of economic expansion.

Sustainable energy investment in India went up to US$ 3.7 billion in 2008, up 12 per cent since 2007. It included asset finance of US$ 3.2 billion, up by 36 per cent. Venture capital and private equity saw an increase of 270 per cent to US$ 493 million. Mergers and acquisition activities totaled US$ 585 million. Most acquisition activity was centered on biomass, small hydro and wind projects, according to a new report, Global Trends in Sustainable Energy Investment 2009.

Moreover, according to a senior official with the US Department of Energy, 60 Indian cities will be solar powered by 2020 if India is able to generate 20,000 MW of solar energy by then.

The US Department of Energy and the All India Institute of Local Self Government (AIILSG) has launched a joint training programme on 'Energy efficient and green cities' in Goa, which will train Indian experts, universities, local self governments and civic bodies on getting cities to move to solar powered energy.

India's sustained work towards reducing Greenhouse Gases (GHG) will ensure that the country's per capita emission of GHG will continue to be low until 2030-31, and it is estimated that the per capita emission in 2031 will be lower than per capita global emission of GHG in 2005, according to a new study. Even in 2031, India's per capita GHG emissions would stay under four tonnes of CO2, which is lower than the global per capita emission of 4.22 tonnes of CO2 in 2005.

**Corporate Initiatives**

- Global systems and services company Dell, in partnership with The Energy and Resources Institute (TERI), has launched 'The Climate Eduxchange' – an IT-

enabled initiative to improve environment education in schools across India. The campaign aims to raise awareness and understanding about climate change issues among students and teachers of all disciplines.

- Moreover, Dell has banned the export of non-working electronics to developing countries as part of its global policy on responsible electronics disposal.
- SOS Children's Villages of India and Coca-Cola India announced the commencement of work on 24 million litres of rainwater harvesting (RWH) project at SOS Children's Village in Aluva near Kochi. The project, on completion, will help ensure safe drinking water for children and nearby communities.

**Clean Energy and Technology**

The Energy Efficiency Indicator (EEI) survey for corporate India, released recently, reveals that 47 per cent of the respondents are paying more attention to energy efficiency, compared to last year and 94 per cent of the respondents feel that energy management is extremely important. An increase in capital investments for energy efficiency is needed, say 62 per cent, while 72 per cent of the respondents feel their organisations can achieve more energy efficiency from operating budgets. More than 92 per cent of the respondents say energy efficiency is a priority in new construction as well as in renovation projects.

**Corporate Investments**

- Investors from the US and European countries are keen to invest around US$ 416.4 million to promote and equip small and medium enterprises engaged in green business such as advance technologies for water management, agriculture/organic products, clean technologies, ecotourism, renewable energy, green building materials, etc.
- PV Technologies India (a subsidiary of Moser Baer), Titan Energy Systems, Reliance Industries Ltd, Tata BP Solar Power are among the 12 Solar Photo Voltaic projects filed under Special Incentive Package Scheme (SIPS), which have received in-principle clearance from the Government. Together, these 12 projects would entail an investment of US$ 16.34 billion over a 10-year period.

- Finnish company WinWind Power Energy opened its US$ 77.5 million wind turbine-cum-blade manufacturing facility near Chennai.
- Clinton Climate Initiative (CCI), a programme of US-based William J Clinton Foundation, has signed a memorandum of understanding (MoU) with Gujarat government for setting up 5 solar parks in Gujarat. The proposed 3000 MW solar power project will see an investment of over US$ 10.3 billion.
- International Finance Corporation, a member of the World Bank Group, has proposed to be an investor in South Asia Clean Energy Fund (SACEF) by investing US$ 20 million. SACEF aims to raise US$ 200 million. The fund will target companies located in India and will also eye regions like Sri Lanka, Bangladesh and Nepal.

**Government Initiatives**

- The government has formulated the National Policy on Biofuels and given its approval for setting up the National Bio-fuel Coordination Committee and Bio-Fuel Steering Committee. Under the policy, it targets increasing the blending of biofuels with petrol and diesel to 20 per cent by 2017.
- Indian Renewable Energy Development Agency (IREDA) will be investing around US$ 3.39 billion for the development of renewable energy (RE) sector projects during the 11th Five Year Plan. As per Planning Commission estimates, RE projects worth US$ 15.97 billion, (expected to generate 15,000 mw power), is likely to come up in the Plan.
- The government is considering a regulation to make use of renewable energy mandatory for special economic zones (SEZ) to save on traditional fuel like coal and diesel.
- India is likely to spend over US$ 20.4 billion on setting up of power plants based on renewable energy sources by the end of 2011-12.
- The Prime Minister's Council on Climate Change has given an in-principle nod to the National Mission on Enhanced Energy Efficiency. Under the Mission, energy efficiency improvement targets will be assigned to the country's most energy-intensive industrial units. Other Mission initiatives include expanded use of the carbon market to help achieve market transformation towards more energy-

efficient equipment and appliances, and the creation of two funds to help channel investment into energy-efficiency projects.

## 2.5 ENVIRONMENT VS DEVELOPMENT

If deterioration of the global environment over the past several decades is any guide, the coming century does not hold out much promise for reversing these trends, many environmentalists are warning as the millennium comes to a close. Rising Earth temperatures, record losses in biodiversity and species extinction, increasing demands and dwindling supplies of fresh water, only seem to be getting worse.

'If I look at the global environmental trends that we have been tracking since we first launched the Worldwatch Institute 25 years ago, and if I simply extrapolate these trends a few years into the next century, the outlook is alarming to say the least,' says Lester Brown, president of the Washington-based think-tank. On the up-side, the past several decades has seen citizens and environmental groups, or non-governmental organisations (NGOs), worldwide pulling together in unprecedented numbers to pressure governments to pass laws to protect the ozone layer, ban toxic chemicals in the environment, reduce air and water pollution, and protect endangered species and habitats. Seeking a balance between economic development and environmental protection, NGOs have played a major role in shaping international environmental treaties, including the UN Convention on Biological Diversity, the Kyoto Protocol on Climate Change, and the Basel Convention, which bans exporting hazardous wastes from industrialised nations to developing countries.

Yet as the millennium pulls to a close, the political and financial structure of the world economy, which has become increasingly dominated by powerful multinational corporations, is directly at odds with efforts to promote a healthy Earth, executive director of the Transnational Resource and Action Centre, the San Francisco-based corporate watchdog.

One clear example of this has been the success of powerful multinational oil and gas industries in swaying the US Senate against ratifying the Kyoto Protocol on climate change, an international treaty seeking to reduce emissions of heat-trapping 'greenhouse' gases. Scientists believe that such emissions, caused by the burning of fossil fuels, will

warm the Earth and result in drastic climate change, including increasing the intensity and frequency of floods, droughts, and storms.

If current record-breaking warming trends continue, average global temperatures could rise between 1 and 3.5 degrees centigrade by the year 2050, according to expert studies.

The challenge in the 21st century is to replace the corporate-dominated paradigm that worships the bottom-line with a framework that puts the environment, human rights, and labour rights first. In the past several decades, NGOs have applied a diverse array of strategies to counter corporate power including promoting laws to protect the environment, developing lawsuits against governments and corporations, and passing company shareholder resolutions.

Citizens in Ecuador, who see their own country's court systems as inadequate, for example, have been attempting to hold US oil giant Texaco accountable for its past operations, by suing the company in US courts. Similar suits have been filed in the US court system against UNOCAL and Chevron for their activities abroad. While praising these efforts, Peter Montague, director of the Maryland-based Environmental Research Foundation, says the environmental movement must pay closer attention to how the push for trade liberalisation is eroding the power of nation-states. NGOs will become irrelevant if national governments lose their capacity to govern because power has been transferred to international trade bodies.

After the passage of the North American Free Trade Agreement (NAFTA), for example, a US firm complained that it had been illegally prevented from opening a waste disposal plant because of environmental zoning laws in the Mexican state of San Luis Potosi.

Through NAFTA, Metalclad corporation sought some $90 million in damages since it said state authorities were - against trade rules - prohibiting it from making a profit since they declared the site an ecological zone and refused to allow the firm to reopen the facility.

Similarly, many domestic environmental regulations - which NGOs have worked very hard to pass into law - have been challenged through the World Trade Organisation (WTO) and hence weakened or abolished, warn environmentalists. The United States, for

instance, gutted provisions of the Marine Mammal Protection Act, the Clean Air Act, and its Endangered Species Act after these environmental policies were challenged before the WTO, according to a recent report released by Public Citizen, a Washington-based NGO founded by consumer advocate Ralph Nader. This undemocratic trend must be reversed and power must be returned to governments.

Citizen groups and environmental organisations have been trying to guide global trade by pressuring governments to attach environmental provisions to trade agreements and pressure international financial institutions like the World Bank, to adopt minimal environmental and social standards for funding projects. Using lessons from studying these institutions, environmental groups, including Indonesia-based Bioforum and Friends of the Earth Japan, have begun a new campaign to reform public export-credit lending agencies which operate without social and environmental standards.

Designed to help a nation's firms compete for business abroad, these agencies provide publicly backed loans, guarantees and insurance to corporations seeking to do business in developing countries. Another challenge in the coming decades is genetic modification and environmentalists say they will keep a close watch on companies such as Novartis and Monsanto, which are heavily pushing their new technological innovations in biological engineering. 'We are in the midst of a radical, historic transition - from the Industrial Age to the Biotechnical Age,' says Jeremy Rifkin, president of the Washington-based Foundation on Economic Trends in his book, The Biotech Century.

Environmental groups, including Greenpeace and the Union of Concerned Scientists, worry that the mass release of thousands of genetically engineered crops into the environment will cause 'super-weeds' through unintentional cross-breeding and hence irreversible damage to the Earth. Mass extinction of plant, animal and insect species will also be a trend environmentalists hope to reverse. John Tuxill, a researcher at the Worldwatch Institute, says that as critical habitat is logged or developed, extinction rates have accelerated this century to at least 1,000 species per year. 'These numbers indicate we now live in a time of mass extinction - a global evolutionary upheaval in the diversity and composition of life,' he says. 'What we need now is a rapid shift in consciousness, a dawning awareness in people everywhere that we have to shift quickly to a sustainable

economy if we want to avoid damaging our natural support systems beyond repair,' says the Institute's founder Lester Brown.

For such a shift to happen, environmental organisations need to focus on organising people at the community level and working closely with other social movements, such as the human rights and civil rights movements. The power of civil disobedience and mass movements has been harnessed and then forgotten at different points in the century, But the huge upcoming challenge, will be to ensure that discontent with corporate-led globalisation is not captured by nationalist xenophobic responses such as the rise of right-wing militia groups in the United States, India's BJP party or France's Jean-Marie Le Pen.

Instead, environmental and related movements need to work hard to harness the discontent with corporate power to promote democratic responses that value human rights and multi-racial and multi-ethnic responses to solving the problems.

**Activity 2**

1. Define sustainable development. Discuss its scope and its relevance in economics.
2. Discuss Indian government initiatives to achieve sustainable development in long run.
3. What are the trade off of environment and development? How these problems could be solved using the approach of sustainable development?

## 2.6 SUMMARY

Sustainable Development stands for meeting the needs of present generations without jeopardizing the ability of futures generations to meet their own needs – in other words, a better quality of life for everyone, now and for generations to come. It offers a vision of progress that integrates immediate and longer-term objectives, local and global action, and regards social, economic and environmental issues as inseparable and interdependent components of human progress. Further in the unit it has been discussed that environment protection is equally important area of consideration which will not be brought about by policies only it must be taken up by society at large as a principle guiding the many choices each citizen makes every day, as well as the big political and

economic decisions that have. This requires profound changes in thinking, in economic and social structures and in consumption and production patterns.

## 2.7 FURTHER READINGS


- Book Review on An Introduction to Sustainable Development by Peter Rogers, Kazi Jalal, & John Boyd Sustainability: Science, Practice, & Policy, Published online June 18, 2008
- Pezzey, J; M. Toman (January 2002). "The Economics of Sustainability:A Review of Journal Articles". Resources for the Future DP 02-03: 1-36.
- Mark Jarzombek, "Sustainability - Architecture: between Fuzzy Systems and Wicked Problems," Blueprints 21/1 (Winter 2003),

# UNIT 3

# MACRO ECONOMIC POLICIES AND ENVIRONMENT

**Objectives**

***After studying this unit you should be able to:***

- *Understand the fundamental issues of macroeconomics and sustainability*
- *Analyze the new microeconomic policy for the 21st century*
- *Have the knowledge of environmental and economic accounting*
- *Appreciate the concept of environmentally corrected GDP*

**Structure**

3.1 Introduction

3.2 Fundamental issues of macroeconomics and sustainability

3.3 Redefining microeconomic theory and policy for the 21st century

3.4 Environmental and economic accounting – the integrated approach

3.5 Environmentally corrected GDP

3.6 Summary

3.7 Further readings

## 3.1 INTRODUCTION

The trend in mainstream economic thought about macroeconomic policy has been towards minimalism. In the optimistic Keynesian phase of the 1960's, it was assumed that both fiscal and monetary policy were effective tools for macroeconomic management. But the influence of monetarist and New Classical critiques has led to a gradual erosion of theoretical support for activist government policy. First fiscal policy fell by the wayside, perceived as too slow and possibly counterproductive in its impacts. Then New Classical and rational expectations critiques suggested that even monetary policy was ineffective. Thus the role of government policy has been reduced to a cautious effort not to make things worse but in effect a return to an economics of laissez-faire.

In contrast, a sustainability perspective implies that radical and proactive government policies are required to achieve economic development that is both socially

just and ecologically sound. The path of laissez-faire leads to increasing intra- and international inequality as well as increasing environmental destruction. To some extent the course of market economies can be steered through the use of sound microeconomic policies. But the fundamental redirection required for sustainable development cannot be achieved without reorienting macroeconomic policy also.

Many of the basic tenets of macroeconomic policy need to be redefined in the context of current global problems. The objectives of macroeconomic policy should include economic stabilization, distributional equity, broad social goals such as income security, education, and universal health care, and the management of economic growth. There is an increasing recognition that the achievement of social goals is essential to environmental sustainability. Regarding growth, while earlier macroeconomic theorists generally assumed that growth was good, ecological economists such as Herman Daly have suggested that growth should be limited and that a sustainable economic scale, rather than exponential growth, should be the goal of macroeconomic policy.

The time is ripe for a reassessment of macroeconomic theory and policy. The goal should be to provide a theoretical basis for the reorientation of macro policy at the national and international levels, linking efforts to promote local-level sustainability and equity with greening and restructuring of multilateral institutions.

Many macroeconomic policies have an indirect and a wide spread impact on the countries ' resources and the environment'. Stabilization and structural adjustment programs aim for a stable economy over the long run. Macro economic policies may or may not be successful in generating economic growth but these policies have an indirect impact on the environment due to changes in income, taxes, subsidies, public revenue and innovative capacity. Many studies have analyzed the effect of stabilization and structural adjustment on the environment (Markandya 1994; Munasinghe and Cruz 1995; Reed 1996; Lopez et.al. 1998; Munasinghe et al. 2000).

**The issues of interest are:**

1. How could one assess these impacts?
2. What actions if any need to be taken to correct the negative environmental effects.

Major economic reforms that are likely to affect the environment are the short-term stabilization programmes (Fiscal policy, monetary policy, and Exchange rate policy), medium-term structural and Sectoral Adjustment Programmes (trade liberalization, domestic pricing policies, non price incentives).

The box below summarizes the major environmental linkages.

| Type | Target | Variables | Anticipated Impact | Examine Impacts through |
|---|---|---|---|---|
| Short-term Macro | Fiscal | Government expenditure | +/- | Drought relief, food aid, agricultural extension, environmental management. |
| | | Taxes | +/- | Changed demand for resources, environmental charges |
| | | Subsidies | +/- | Input effect: machinery, fertilizer, water |
| | Monetary | Credit | +/- | Reduced credit for inputs. |
| | | Interest rates | +/- | Reduced investment and resource demand. |
| | Exchange rate | Devaluation | +/- | Import effect: Increased prices of imported inputs-energy, fertilizer. Export Effect: Increased crops, natural resources. |
| | Trade | Import/Export Control | +/- | Removal of protectionist taxes has similar effects as devaluation but for specific commodities |

| | | | | |
|---|---|---|---|---|
| | | Trade controls | +/- | Similar effects as trade taxes. Possibility of technological lock-in. |
| | Pricing policy | Price Controls | +/- | Impacts of price changes depend on crop characteristics, farming practices. |
| Medium to long term macro | | Reduce subsidies | +/- | Reduced use of pesticides, fertilizers, energy, credit, irrigation, machinery |
| | | Increased taxes | + | Indirect impact through reduced demand |
| | Institutional reform | Land | + | More on farm investment and sustainable resource management. |
| | | Financial | + | Improved credit may promote sustainability |
| | | Research and extension | + | Improved services promote sustainable resource management |
| | Investment policies | Training | + | Investment in human capital through agricultural extension wildlife and resource management |
| | | Valuation | + | Project evaluation to include environmental costs and benefits. |
| Investment policy | | Technology | + | Industrial pollution abatement technologies and new agricultural technologies impact on environment |
| | | Public infrastructure | +/- | May increase access to natural resources and encourage exploitation. May also have an impact the price responsiveness of producers. |

Many macro economic policies have an impact on poverty and thereby, it is claimed, on the environment. Poverty and environmental degradation have been studied by looking at how the two are correlated over time, as well as how they are correlated across society at a given point in time. Along with the poverty, for a fuller appreciation of macro economic policy impacts it is important to look at the linkages between population and environment. This is because there is a wide spread perception that high population density and high rates of population are a direct cause of environmental degradation.

## 3.2 FUNDAMENTAL ISSUES OF MACROECONOMICS AND SUSTAINABILITY

As the concept of sustainable development has been refined and developed, many new perspectives on economic theory and policy have been introduced. An overview of work on sustainable development recently published by the Global Development and Environment Institute includes significant contributions on the topics of: natural capital, current and inter-generational equity, "green" accounting, "green" tax reform, growth and the environmental kuznets curve debate, trade and structural adjustment, globalization, and international institutional reform. It seems evident that these multi-faceted theoretical and practical issues arising out of the overlap between environmental, social, and economic analysis should have major implications for macroeconomic policy. But there is as yet little work on reforming macroeconomic theory and policy to take account of sustainability.

There has been discussion of a variety of microeconomic policies which can promote environmental sustainability. But what is implied regarding macroeconomic policy? Since Herman Daly first called for an environmental macroeconomics a decade ago, there has been relatively little forward progress on this issue – certainly none that has penetrated the mainstream of macroeconomic theory, practice, and teaching. There have been new approaches to macroeconomic measurement, taking into account economic and social factors. A recent article by Anthony Heyes suggests a modification of macroeconomic IS-LM analysis to include environmental constraints (of which more

later). This is a welcome response to Daly's call for environmental macroeconomics, but there have not been many other such responses.

The question is especially tantalizing since there are signs that this may be a moment of opportunity for influencing, and altering, mainstream macroeconomics. The field has strayed far from its Keynesian origins, and in doing so has become, like other areas of standard economics, highly abstract and mathematical. But at the same time there are some influential voices within the mainstream, such as former World Bank chief economist Joseph Stiglitz, decrying the decoupling of macroeconomic theory from real-world problems, and calling for a reorientation. Stiglitz' main concern is not environmental, but he does point to the social devastation wrought in many developing nations by the so-called "Washington consensus" on macroeconomic policy.

The long-term trend in mainstream economic thought about macroeconomic policy has been towards minimalism. In the optimistic Keynesian phase of the 1960's, it was assumed that both fiscal and monetary policy were effective tools for macroeconomic management. But the success of monetarist and New Classical critiques led to a gradual erosion of theoretical support for activist government policy. First fiscal policy fell by the wayside, perceived as too slow and possibly counterproductive in its impacts. The focus moved to central bank monetary policies as the only practical means of government intervention, with the limited goal of price stability. Then rational expectations and New Classical critiques suggested that even monetary policy was ineffective. Thus the role of government is reduced to a cautious effort not to make things worse – in effect a return to an economics of laissez-faire.

By contrast, the sustainability perspective implies that radical and proactive government policies are required to achieve economic development which is both socially just and ecologically sound. The path of laissez-faire leads to increasing inter- and intra-national inequality and increasing environmental destruction. To some extent the course of market economies can be steered through the use of sound microeconomic policies. But the fundamental redirection required for sustainable development cannot be achieved without reorienting macroeconomic policy also. Substantial changes in economic policy are needed in order to promote sustainability as well as more traditional economic goals of efficiency, increased consumption (in the sustainability perspective,

for those who need it) and macroeconomic stability. In particular, environmental and social dimensions must be integrated into economic policy.

It is therefore worthwhile to return to the basic goals of macroeconomic policy, as set forth by Keynes, his contemporaries, and his immediate successors, and to ask the question whether some of the essential elements of macroeconomics have been lost in the last half-century of evolution of economic thought. "New occasions teach new duties": the appropriate macroeconomic goals for the twenty-first century are very different from those which confronted Keynes and his colleagues in the immediate post-World War II period. Yet there are similarities in the scope of problems on a global scale which suggest that the broader view taken at an earlier stage in economic thought may be relevant as we consider new issues unforeseen fifty years ago.

## A Broad View of Macroeconomic Policy Goals

Let us review some of the basic functions of macroeconomic policy, broadly conceived.

1. Economic stabilization, avoiding excessive inflation or recession – the best known function, which has often but mistakenly been viewed as the only appropriate goal for macro policy.
2. Distributional equity, which played an important role in early Keynesian analysis and in the work of Sraffa, Kaldor, Joan Robinson, and Kalecki.
3. The achievement of broad social goals, such as income security, education, and universal health care. These were integral to "New Deal" Keynesian policies, but have become incidental in economists' purely quantitative analysis of the macroeconomy.
4. Providing a stable basis for economic development. The dynamics of economic growth were explored by Harrod and Domar and later Solow. These theorists generally assumed that growth was good, considering an ultimate steady-state economy only as a theoretical construct. More recently, ecological economists such as Daly have suggested that growth should be limited and that a sustainable economic scale, rather than exponential growth, should be the goal of macroeconomic policy. Within mainstream economics, the development of endogenous growth theories, taking into account the role of human and

potentially of natural capital in long-term growth, provides another perspective on the importance of policy determinants of growth.

The recent macroeconomic crises in Asia and Japan suggest that the first function is more important than implied in the modern, laissez-faire-oriented approach to macroeconomics. The tendency of unregulated capitalist economies to excessive cycles of boom and bust, emphasized by Keynes and dismissed by New Classicists, has been re-explored by Krugman in the light of the Asian crisis.

The importance of the second and third functions has been emphasized by critiques of International Monetary Fund (IMF) and World Bank structural adjustment policies, including those by Joseph Stiglitz. Contractionary macroeconomic policies have devastating effects on social equity, as well as on income distribution, with the heaviest burden of economic contraction being borne by the poorest. Expansionary, export-led growth is no panacea: growing income inequality and loss of social safety nets threatens the "success stories" of rapidly developing nations such as China. Issues of fairness in distribution and social investment need to be included in a redefined set of economic policy goals.

Regarding the fourth function, even the World Bank acknowledges that the scale of global growth poses enormous environmental problems for the twenty-first century. Whether or not Daly's approach to growth limits is adopted, it is clear that economic growth needs to be steered in an environmentally sustainable direction, implying some degree of macroeconomic planning (not in the sense of a centrally-planned economy, but in the sense of indicative planning for long-run energy and resource use, as implied for example by the Kyoto process).

All four functions, not just the first, will be important in the macroeconomics of the twenty-first century. This will require a rethinking and reorientation of both theory and policy, at the national and international levels.

## 3.3 REDEFINING MACROECONOMIC THEORY AND POLICY FOR THE TWENTY-FIRST CENTURY

A macroeconomics that is consistent with sustainable development must return to, and expand upon, the fundamental principles of Keynes, without the dilution inherent in

the neoclassical interpretation. An initial list of the characteristics of such a macroeconomics should include:

**Simplicity and transparency**

This appears to contradict the post-Walrasian emphasis on complexity. But we should remember that consistency is the hobgoblin of little minds, and that great ideas are typically capable of fairly simple expression. Even a theory involving great mathematical complexity in its formal derivation may have fairly straightforward policy conclusions.

One of the great problems with current macroeconomics is that, unlike the relatively simple microeconomics of markets, it is enormously confusing. After following many tortuous arguments about expectations, shocks, rigidities, and short- and long-term effects, the student of macroeconomics is likely to be totally confused. One macroeconomics text lists seven different explanations for recession: traditional Keynesianism, misperception theory, real business cycle theory, sectoral shift models, and new Keynesian theories of wage and price rigidities, coordination failures, and political business cycle theory – each with completely different policy implications.

In contrast, an ecologically oriented macroeconomics should focus on a simple basic principle: since unregulated markets are volatile and often socially and environmentally disruptive, informed government intervention using fiscal, monetary, and other policy tools is essential. There can be differences over the appropriate policy mix, but there can be no doubt that an activist government role is required to promote economic, environmental, and social sustainability.

**Promotion of social goals**

The more radical formulation of the Keynesian critique is fatal to the concept of market "optimality". Once the self-regulating Walrasian world evaporates, it becomes apparent that many social goals can only be achieved through collective action using democratic institutions of governance. Thus the need for government intervention is more than simply a technical requirement for macroeconomic stability. It represents the only feasible way of achieving goals which are essential for well-being, and which are not supplied, or inadequately supplied, through the market.

The implicitly anti-democratic free-market paradigm insists that dollar votes should rule and the public sphere should be minimized. While conservative economists are free to argue this as their political preference, they should not be able to appeal to any supposed professional consensus to justify it. A realistic macroeconomics requires a different approach, which is why New Classical theorists have attempted to reduce macroeconomics to non-existence. The reassertion of a distinct macroeconomic theory involves, as Keynes recognized, an essential role for social choice. This, not free-market ideology should be the main message of economists to policy-makers and the public.

**Concern for equity**

Even the World Bank has acknowledged that "equity also remains a central concern of the state." As we have noted, earlier Keynesian theories placed emphasis on equitable distribution, both as a social goal and to promote a more stable macroeconomic system. In addition, as Adelman and Amsden have argued, equitable distribution is a strong precondition for effective economic growth in developing economies. In a world of ecological limits, issues of equity take on a particular importance since increased consumption for the poor may depend on moderated consumption by the rich. This reality calls for new attention to the preconditions for macroeconomic stability with limited consumption growth.

**Environmental protection and growth limits**

These issues were not on Keynes' agenda, but as Daly and others have emphasized, they must be an essential part of a twenty-first century macroeconomics. Heyes proposes the addition of an EE schedule indicating environmental equilibrium to the standard IS-LM diagram. The EE schedule is an interesting construction, since it depends both on the installation of environmentally cleaner technology, assumed to be related to the real interest rate (which determines the slope of EE), and on the level of environmental regulation in the economy (which determines its placement). It is not clear whether environmental factors can truly be captured by such a relatively simple formulation (just as IS-LM itself tends to oversimplify macroeconomic relationships). However, a fairly clear and commendable implication of the IS-LM-EE analysis is that economic growth must be accompanied by cleaner technology and stronger

environmental regulation. In this sense, Heyes' proposal fits well with our earlier admonition that ecological macroeconomics should have straightforward and comprehensible policy implications.

**Sustainable trade policies**

One of the important aspects of the expanding critique of free trade and globalization is the issue of control of macroeconomic policy. Critics of free trade have pointed to its negative environmental and social effects, and its tendency to expand corporate power. An equally important concern is the tendency of regional and global free-trade regimes to remove fiscal and monetary policy from national control. This is at issue, for example, in the attempt to promote a common currency within the European Union.

Extensive opposition in Britain and other countries has forced European leaders to retreat on their timetable for the euro. What reasons do people have to be concerned about this issue, other than affection for traditional currencies? Very good reasons. Not only is national cultural autonomy weakened by a soulless euro, but more substantively, control over monetary policy passes from elected national governments and their central banks to a European authority whose democratic mandate is at best weak. People sense that this represents an important aspect of loss of control over their economic destinies.

In the Asian crisis, countries like Malaysia and China, with controls on capital movements, were to some degree isolated from the recessionary contagion. In the wake of the crisis, Joseph Stiglitz and others have criticized the ideological dogmatism that led to an insistence on eliminating barriers to capital movement in East Asia in the name of free trade. While this led to short-term profit opportunities for international financial institutions, it left the area vulnerable to massive speculative capital flows – something which Keynes warned about, and which has led James Tobin to propose the "Tobin tax" on international capital movements.

**International institutional reform**

Keynes and others similarly minded were instrumental in setting up the Bretton Woods institutions to provide international macroeconomic stability. By the end of the century, these institutions were showing their age. One major problem is the lack of global environmental institutions, or of any prominent place for environmental concerns in the mandates of existing institutions. Another is the capture of international monetary

policy-making by economists oriented towards contractionary "classical medicine" approaches. As Paul Streeten has long advocated, this approach disserves development and should be replaced by more aggressive policies aimed at recirculating capital and disseminating technology to promote sustainable development.

The development of such institutions and policies involves a careful consideration of which macroeconomic policy functions are best performed at a national, and which at an international level. Given the other goals of environmental protection and equity mentioned above, the current combination of rapid globalization and classically-oriented contractionary policies is clearly inappropriate, and it is not surprising that it has led to growing resentment and opposition.

## 3.4 ENVIRONMENTAL AND ECONOMIC ACCOUNTING – THE INTEGRATED APPROACH

Growing pressures on the environment and increasing environmental awareness have generated the need for countries to accurately value and account for their environmental and natural resources as a means of developing appropriate economic, trade and sustainable development policies.

Existing systems of national accounts generally do not take account of the impacts of economic and trade activity on resource potentials. National accounts include physical capital as an asset that depreciates over time, but they largely fail to include the depletion of natural capital, which is treated not as a liability but as an income. Similarly, national accounts fail to reflect social factors such as income distribution and poverty reduction. To provide policy makers with more accurate information on progress towards sustainable development and poverty reduction, efforts are required to integrate the environment into national accounts.

The System of Integrated Environmental and Economic Accounting (SEEA) is a tool that can help track natural resource depletion and environmental degradation. Sine the early 1980s, UNEP has been promoting and facilitating the development of this tool in collaboration with the World Bank, the UN Statistical Division, and other organizations. Since the early 1990s, UNEP through ETB has also supported a number of country projects, sponsored a series of workshops, and worked with partners in preparing

a practical handbook entitled "Operational Manual on Integrated Environmental and Economic Accounting". In 2004, UNEP ETB convened a meeting together with UNSD to identify gaps, needs and priorities for moving this work forward. This meeting led to the establishment of a UN Expert Committee on Environmental-Economic Accounting. Within this process, UNEP-ETB developed a Virtual Resource Center with a searchable database for various materials and internet links related to integrate environmental and economic accounting. In response to emerging priorities, UNEP ETB is currently exploring opportunities to work with partners on issues related to the measurement and accounting of carbon storage and other ecosystem services.

## The System of Environmental-Economic Accounting 2003 (SEEA-2003)

The SEEA-2003 is a satellite system of the System of National Accounts (SNA), which is the standard system for organizing economic information. As such, it has a similar structure to the 1993 SNA and shares common definitions and classifications. It provides an integrated set of aggregate environmental and economic information from which indicators of performance can be derived. These can be at the sectoral and macroeconomic level, as well as at more detailed levels, and may guide resource managers and policy makers alike.

The SEEA-2003 provides a set of definitions, classifications, statistical accounts and tables to analyse the interactions between the economy and the environment. It provides a framework for organizing environment and energy statistics together with economic information using common concepts, definitions and classifications. It also enables to analyze links between different environmental domains (e.g. between energy, pollution, land, water, etc).

By bringing the concepts, definitions and classifications of environment and energy statistics closer to those of environmental-economic accounting, the potential use of the data available in both the environment and economic spheres is increased. The SEEA-2003 allows for the incorporation of the environment and energy statistics directly into the national accounting framework, an important tool for economic planning and policy determination. It significantly improves the likelihood that environmental

information is considered more fully in economic decision-making process. In short, the SEEA-2003 provides an integrated framework allowing tradeoffs to be examined.

The integration of information on the economy and energy allows decisions and policies to be designed, analysed and reviewed for effectiveness. In the case of energy and associated air emissions, policy makers need to be aware of the likely consequences for the economy of implementing or increasing targets for reducing air emissions. Similarly, those industries making extensive use of energy resources in production processes need to be aware of the long-term consequences of their use on the environment (e.g. increased temperatures, reduced water availability).

Linking the environment and energy statistics to the accounting framework also increases the checks and balances in the data. It can improve data quality and produce consistent data system from individual sets of environment and energy statistics. The system improves consistency over time and enables comparisons between countries.

The accounting system has substantial analytical value. By integrating economic and environmental and energy accounts it becomes possible to develop a coherent and consistent set of indicators to examine the implications for different patterns of production and consumption of the environment and energy resources, or conversely, to examine the economic consequences of maintaining given environmental standards. Because economic activities and their environmental impacts, in terms of resource use and emissions, can be compared directly, the system makes it possible to calculate intensities and to derive various kinds of indicators. Moreover, since it uses an input-output structure it can be used for modelling; for example the impact of introducing specific energy taxes on resource consumption and emissions.

The SEEA 2003 comprises four categories of accounts:

- *Flow accounts for pollution, energy and materials* (Chapters 3 and 4) These accounts provide information at the industry level about the use of energy and materials as inputs to production and the generation of pollutants and solid waste.
- *Environmental protection and resource management expenditure accounts* (Chapters 5 and 6). These accounts identify expenditures incurred by industry, government and households to protect the environment or to manage natural resources. They take those elements of the existing SNA which are relevant to the

good management of the environment and show how the environment-related transactions can be made more explicit.

- *Natural resource asset accounts* (Chapters 7 and 8). These accounts record stocks and changes in stocks of natural resources such as land, fish, forest, water and minerals.
- *Valuation of non-market flow and environmentally adjusted aggregates* (Chapters 9 and 10). This component presents non-market valuation techniques and their applicability in answering specific policy questions. It discusses the calculation of several macroeconomic aggregates adjusted for depletion and degradation costs and their advantages and disadvantages. It also considers adjustments concerning the so-called defensive expenditures.

## The revision process of the SEEA-2003

After the finalization of the SEEA-2003, countries felt that it was timely to focus efforts on elevating environmental-economic accounting to an international statistical standard, mainstreaming it in national statistical offices and promoting its uses in the users' community. In 2005, the UN Statistical Commission approved the creation of the UN Committee of Experts on Environmental-Economic Accounting (UNCEEA), a strategic body responsible for bringing forward the above objectives.

The following five main elements of work identified for the UNCEEA include:

(a) ***Coordination***: It was felt that a stronger coordination, in particular among the international agencies active in the environmental field, would be necessary in order to raise the profile of environmental-economic accounting;

(b) ***Promotion of the accounts:*** Since environmental-economic accounting is a new area of statistics, the United Nations Statistical Commission underscored the need for raising awareness of the uses of the accounts through the promotion of environmental-economic analysis and formulating international priorities based on canvassing users' needs;

(c) ***Methodological research:*** SEEA 2003 is a handbook of best practices. When a consensus could not be reached, a list of options, rather than a single recommendation, was presented. The UNCEEA has been entrusted by the

Statistical Commission to organize and steer the process of the revision of the SEEA-2003 to elevate it to an international statistical standard;

(d) ***Technical Cooperation:*** With the publication of SEEA, it was considered timely to develop an implementation strategy in countries. The Committee would play a role in coordinating development of training material and foster exchanges of best practices as well as maintaining a list of on-going country projects so as to avoid duplication of efforts;

(e) ***Harmonization of data collection activities with environmental accounting concepts and definitions.*** It was considered important that environment and related statistics becomes firmly aligned with environmental-economic accounting.

At its last meeting in June 2006, the UNCEEA identified energy accounts as an important topic to be included prominently in the revision of the SEEA-2003. The UNCEEA considered that the methodology is well advanced and there exists considerable practical experience in countries to warrant the elevation of energy accounts to international statistical standard.

The UN Committee is now working on the preparation of a project management framework for the revision process of the SEEA-2003. The framework will delineate the role and responsibilities of the various groups involved in the revision process; including the governance structure, finalize an agreed research agenda including a list of issues to be addressed with timelines and deliverables. The London Group on Environmental Accounting, given its expertise and role in the advancement of methodologies in environmental-economic accounting, has been asked and has agreed to assist the UN Committee of Experts in addressing a large number of issues which will be included in the agreed research agenda for the revision of the SEEA- 2003.

Given the leading role of the Oslo Group in advancing methodologies in energy statistics, the Committee considered important to develop cooperation with the Oslo Group. To this end, the Chair of the UNCEEA requested the Chair of the Oslo Group to consider accepting to develop and solve a list of issues on energy accounts to be included in the research agenda for the revision of the SEEA-2003.

## 3.5 ENVIRONMENTALLY CORRECTED GDP

Measurement of Net National Product (NNP) taking in to account the externalities of using natural resources requires the generalization of conventional national income accounts to be done for the economy. Conceptually these generalizations could be done as in the UN methodology of integrated environmental and economic accounting (UN, 1993) and in other recent attempts that use input-output models. However, there is a large gap between what is empirically achieved so far and the requirement of these generalized methods of accounting. These methods require an aggregation of changes in natural resource stocks at the micro level or an aggregation of changes over the firms and households to arrive at changes at the level of sectors and from the sector to the macro or national level aggregates. There are formidable empirical problems in measuring the changes in resource stocks introduced by firms or projects and the monetary valuation of these changes.

The UN methodology describes the generalization of production and use accounts for different sectors in the economy without explaining how the aggregation of changes in natural resources stocks introduced by firms and households could be done. The depletion of resource stock at the macro level could be unambiguously measured in the case of exhaustible natural resources while there are difficulties in measuring depletion in the case of environmental resource stocks.

Production and use accounts at the sector or macro level could be prepared by simply adding the firm-level production and uses of fossil fuels or minerals or ores. The market determined resource rents could be used to prepare the monetary accounts of depletion of exhaustible resources. However in the case of environmental resource stocks, the depletion and the monetary valuation of it could be firm or region-specific. For example, in the case of atmospheric quality measured in Particulate Matter (PM10), the depletion should be with reference to an airshed and the in the case of water quality measured in Biological Oxygen Demand (BOD) it should be in the context of a watershed. The valuation of environmental quality measured either in terms of cost of improving it or in terms of benefits to the households could be also region or site-specific. Therefore for the environmental resource stocks, region or project specific, physical and monetary accounts have to be developed. While the national-level physical

accounts of environmental changes could not be developed from the regional accounts the aggregate monetary accounts could be developed. Detailed micro level studies of environmental resource accounting provide micro foundations of integrated environmental and economic accounting for measuring the Green GDP of countries.

## Environmentally Sustainable GDP

Measurement of environmentally sustainable income requires a system of national accounts that integrates the environmental and economic problems. There are many definitions of sustainable income. The general view about sustainable income is that it is the maximum attainable income in one period with the guarantee that the same level of income will be available in future periods given the constraints on the resources, viz. labor, man made capital and natural capital. Therefore, income is directly related to the availability of man made and natural capital. Sustainable income defined in this way represents the welfare of the nation and there is a lot of discussion in the literature about whether the Net National Product (NNP) would appropriately represent it. Samuelson (1961) has argued, the rigorous search for a meaningful welfare concept leads to a rejection of current income concepts like NNP and arrives at something closer to a wealth like magnitude such as the present discounted value of future consumption. However, Weitzman (1976) has shown that in theory, the NNP is a proxy for the present discounted value of future consumption.

It is long recognized that the conventional system of national accounts (SNA) to measure NNP has treated environmental resources and their role in the economy inconsistently. Under SNA, NNP increases when natural resource stocks are depleted and the quality of environment is reduced by pollution. As could be seen in Section 2 of this chapter, the correct approach to natural resources accounting is to account for the depletion of natural resources and the fall in the environmental quality in estimating the NNP. There is now a lot of literature about the problem of estimating NNP and the sustainable use of natural resources. Studies by Solow (1974) and Hartwick (1977, 1978a,b) have tried to derive the conditions under which real consumption expenditure might be maintained despite declining stocks of exhaustible resources (fossil fuels, minerals and metals). The main result of these studies known as the Hartwick rule, states that consumption may be held constant in the face of exhaustible resources only if the

rents deriving from the inter temporally efficient use of those resources are reinvested in the reproducible capital.

The main criticism about the Solow-Hartwick definition of sustainable income is that the manmade capital could not be substituted to natural capital. Natural capital can be exploited by man, but cannot be created by man. According to the thermodynamic school (Christensen, 1989), natural capital and manmade capital are not substitutable. One can think of two subsets of inputs, one containing the natural capital stock 'prim ry inputs' and another contain manmade capital and labor 'agents of transformation'. The substitution possibilities within each group can be high while they are limited between the groups. Increasing income means increasing the use of inputs from both groups

Given the limited substitutability between manmade capital and natural capital, it is necessary to maintain some amount of the natural capital stock constant in order to maintain the real income constant at the current level over time (Pearce et al., 1989: Klaasen and Opschoor, 1991; Pearce and Turner, 1990). This can be a heavy restriction on development if the current levels of natural capital stocks are chosen as a constraint, since it requires a banning of all projects and policies impacting the natural capital stock.

As a way out of this problem, Pearce et al. suggest the use of shadow projects. These are the projects and policies designed to produce environmental benefits in terms of additions to natural capital to exactly offset the reduction in natural capital resulting from the developmental projects and policies. Daly (1990) has suggested some operational principles for maintaining natural capital at a sustainable level. For example, (i) in the case of renewable resources, set all harvest levels at less than or equal to the population growth rate for some predetermined population size, (ii) for pollution, establish assimilative capacities for receiving ecosystems and maintain waste discharges below these levels, and (iii) for non-renewable resources, receipts from non-renewable extraction should be divided into an income stream and an investment stream. The investment stream should be invested in renewable substitutes (biomass for oil). In a free market situation, there may not be adequate incentives for the economic activities to undertake shadow projects and following the operative principles described above, for maintaining the natural capital at a sustainable level within the pace of economic development.

The environmental regulation with the appropriate instruments and institutions could provide sufficient incentives for profit maximizing activities for the sustainable use of natural resources.

## 3.6 SUMMARY

Given the urgency of many macro-level and global environmental issues, together with the clearly inadequate state of current macroeconomic theory, it appears that the time is ripe for a reassessment of macroeconomic theory and policy. This reassessment could draw on some mainstream approaches, especially the New Keynesian variety as well as more radical Keynesian or ecological perspectives. With this view various concepts related to micro economic policy in context of environment have been discussed in the unit. Integrated Environmental-Economic accounting was described as it provides a way of structuring information that allows decision makers and others to gain new insights into public policy issues. It enables to systematically analyse the impact of the environment on the economy, and *vice versa*. Finally the concept of environmentally corrected GDP was explained. With this approach Production and use accounts at the sector or macro level could be prepared by simply adding the firm-level production and uses of fossil fuels or minerals or ores.

## 3.7 FURTHER READINGS


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Unit 1 Environment regulations in India
Unit 2 Forest management and social forestry



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Unit 1 Environment regulations in India
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PAPER - IV (A) M.A. (PREVIOUS) ECONOMICS

# BLOCK - III

# BLOCK 3 ENVIRONMENTAL AND NATURAL RESOURCE PROBLEMS IN INDIA

Recent changes in economic environment of developing nations like India have proved the relevance of forest management as an important driver of growth. This unit presents to you the patterns of forest management including policies pertaining to laws, protected areas, social forestry and participation of people in effective forest management.

Unit 1 throws light on environment regulation in India. Mechanism for environment regulation in India is discussed with environmental law enforcement. Policy instruments for controlling air and water pollution along with related strategies have been explained in detail.

Unit 2 deals with forest management and social forestry in India. It focuses on history of forest management in India and forest policy and laws. Other concerns are people's participation in management of common and forest land; joint protected area management and Social forestry.

# UNIT 1

# ENVIRONMENT REGULATIONS IN INDIA

**Objectives**

**After completing this unit, you should be able to:**

- Understand the mechanism for environment regulation in India
- Become aware of the environmental law and its enforcement in India along with major jurisdictional questions
- Know the policy instruments for controlling air and water pollution

**Structure**

1.1 Introduction

1.2 Mechanism for environment regulation in India

1.3 Environmental law enforcement

1.4 Policy instruments for controlling air and water pollution

1.5 Summary

1.6 Further reading

## 1.1 INTRODUCTION

There is a basic division of power between the centre and the states in India, reflecting the federal nature of the Indian Constitution. The mandate of the Central Pollution Control Board (CPCB) is to set environmental standards for all plants in India, lay down ambient standards, and coordinate the activities of the State Pollution Control Boards (SPCBs). The implementation of environmental laws and their enforcement, however, are decentralized, and are the responsibility of the SPCBs. Anecdotal evidence suggests wide variations in enforcement across the states. In fact it has been argued (Gupta 1996) that although states cannot compete by lowering environmental standards in orders to attract new investment; they can get around this by lax enforcement.

The two main pollution control statutes in India are the Water (Prevention and Control of Pollution) Act of 1974, and the Air (Prevention and Control of Pollution) Act

which came into being in 1981. Thereafter, Parliament passed the Environment (Protection) Act in 1986. This was designed to act as umbrella legislation for the environment, with responsibility for administering the new legislation falling on the Central and State Boards. The law prohibits the pollution of water bodies and requires that generators of effluent/ discharges get the prior consent of the SPCBs. This consent to operate must be renewed periodically.

SPCBs have the legal authority to conduct periodic inspections of plants to check whether they have the appropriate consent to operate, whether they have effluent treatment plants, take samples for analysis, etc. Some of these inspections are also programmed in response to public requests and litigation. The penalty for non-compliance is fines and imprisonment, but until 1988 the enforcement authority of the SPCBs was very weak. It was limited to criminal prosecution (with its attendant delays) and seeking injunctions to restrain polluters. Now, however, SPCBs have the power to close non-compliant factories or cut-off their water and electricity by administrative orders. The *potential* cost to the plants of non-compliance is thus not trivial, so there should be an incentive for plants to comply with the law. However, compliance depends on *both* monitoring and enforcement of the law by the SPCBs.

Since water pollution regulations have been on the books longest, and there are well known and relatively inexpensive means of testing these emissions, we decided to focus on water pollution monitoring in this paper. Also, we examine the impact of inspections on water pollution emissions to assess just how successful the laws are in their implementation. It is often the case that organizations measure "success" in achieving their policy goals in terms of an increase in spending or the number of actions taken, rather than outcomes. For instance, assessing performance by counting the frequency or absolute number of inspections rather than the resulting environmental quality would be valid if, indeed, inspections have an impact on emissions. In the Indian context, despite a strong legal framework and the existence of a large bureaucracy for dealing with environmental regulation, the public perception is that implementation remains weak.

Given the penalties in force for non-compliance in India and keeping in mind the extent of the SPCBs' powers, it should be emphasized that the impact of inspections on

compliance will be only as strong as the threat of enforcement and punishment faced by the plant. In an environment of corrupt local inspectors or bureaucratic procedures that hamstring action against errant behavior, inspections alone are unlikely to be effective. Also, the reality is that resource constraints at the state level mean that environmental management often degenerates into crisis management. Inspections are undertaken at the time that operating consent is granted, and thereafter usually only in response to complaints, accidents or other emergencies.

In our sample of 250 plants, 51 plants indicated that they had undertaken abatement in response to NGO pressure and 102 said they had done so in response to complaints from neighbouring communities. This led us to conjecture that there would be a limited plant level response to inspections alone.

## 1.2 MECHANISM FOR ENVIRONMENT REGULATION IN INDIA

### The Setting

We are witness to the occurrence of a new phenomenon. The phenomenon of the emergence of Courts of Law in India, perhaps, as the sole dispenser of environmental justice. By delivering landmark judgments, that have, indeed, altered the common man's perception of the court of law as just a forum for dispute resolution and nothing else, the Indian judiciary has carved out a niche for itself as an unique institution. This has been especially so over issues concerning protection of human rights and environment. International legal experts have been unequivocal in terming the Indian Courts of law as trail-blazers, both in terms of laying down new principles of law and in the introduction of innovations in the justice delivery system.

The increasing interest in and a sense of inevitability in approaching the corridors of justice, over every conceivable environmental problem by public interest groups and individuals, bear witness to this unprecedented occurrence. After riding the crest wave of unusual and unprecedented popularity and global attention, for about two decades, the superior judiciary in India, of late, is also getting targeted as an institution that has become complacent and getting more insensitive to constructive criticism. This requires scrutiny.

A detailed analysis of the entire phenomenon would be perfectly in order, in getting an idea of the entire picture. As a first step in that direction, it may be appropriate

to focus on those aspects of the phenomenon that were responsible for putting the courts on a pedestal, while the other two wings of the government, the legislature and the Executive slipped in public esteem. The enquiry in this paper is to contextualize the role of the justice delivery system in India in environmental governance. More specifically, this is to examine the rationale for the occurrence of the phenomenon of looking up to the judiciary as the only reliable bastion of and the final hope for the common man in securing environmental justice.

## Law & Policy-making processes

### *The Ideal*

If one goes by popular perceptions and natural expectations, every law ought to have its roots in, a felt need. The inadequacy or vacuum in the existing system, in meeting the challenges posed by a problem situation, leads to the need to evolve newer laws and more effective tools of implementation. Legal solutions may either emerge out of a process of consultation and consensus building among the affected community or, it may also result from the government taking cognizance of an existing customary practice and strengthen it by investing it with the force of law. The local customs, traditions, practices and solutions may lead to the evolution of a broad policy frame, spelling the local, regional and national principles of governance.

Fashioning a body of law and a set of rules to operationalize the policy and mechanisms of implementation are the next logical steps in the system of governance. Thus, the policy, the law, the institution of implementation, the plan and programme of action and actual implementation in a sequence, in that order, complete the picture of the system of governance, in an ideal situation. Conforming to the Constitutional frame and keeping pace with its evolution, in the scheme of things, would ensure legal legitimacy and constitutional validity to the policy, law and administration.

**The Real Picture**

1. Lack of vision, in foreseeing environmental problems, not evolving appropriate policies, plans and programmes, besides non-dynamic, reactive (rather than being, pro-active), legislative laws, in tackling the complex and ever challenging environmental issues and problems appear to be at the root of the activist stance of the courts of law. The following propositions and illustrative examples,

present the actual state of affairs that is far removed from the ideal condition, stated above.

2. The entire process of evolving policy and law, in the country is a flawed one. It is both an illogical and absurd process. We have policies without laws, laws without policies and policies following legislative efforts!
   (i) The National Agricultural Policy and those of the States, is a classic example of a policy without law. No single legislation encapsulates the contents and concerns of the policy document. This has to be gleaned from a variety of bits and pieces of legislations. Agricultural processes, production, marketing, support price and the like, have not attracted the attention of the lawmaker as yet.
   (ii) Quite a few environmental legislations do not having the backing of a policy document. The wildlife (Protection) Act, 1972, The Forest (Conservation) Act, 1980; Water (Prevention and Control of Pollution) Act, 1974; The Water (Cess) Act, 1977 and Air (Prevention and Control of Pollution) Act, 1981, are only a few examples of such "stand alone" documents.
   (iii) We have the classic case of putting the cart before the horse, with the framework Environment (Protection) Act, 1986, preceding the National Policy and Strategy for Environmental Protection and Sustainable Development. The latter following the former by a gap of 6 years!
3. Environmental Law-making in India has not followed any consistent and logical path of serious deliberation, both at the stage of drafting and consideration on the floor of legislatures, before becoming the law of the land. Even chance remarks or an expression of displeasure over an undesirable environmental situation, by charismatic political leaders have, often, led to the making of laws! The circulars and guidelines as to Joint Forest Management and the Notification as to Coastal Regulation Zone, apparently, are illustrations of this.
4. "Inspirations" from the experiences in the West, have at times contributed to environmental legislations in India. The Water (Prevention & Control of Pollution) Act, 1974, is illustrative of this "inspired" effort. A Scottish law enacted in early 1950's was the source (without any acknowledgement, of course!)

for the Indian effort. But the most astonishing, if not perplexing, aspect of this development is that the Scots repealed their law in 1973 and enacted a new law. The Indian lawmakers resurrected parts of it, from the ash cans of history and clothed it with Indian tri-colour in 1974!

5. Subscription to international legal arrangements and commitment to implement them through ratification, without the necessary national preparation for the same in putting across the Indian points of view, in international fora, have led to making of laws to fulfill our international obligations. The Biodiversity Bill, tabled before the Parliament in May 2000, is one such example. The Indian legislative efforts that were at a formative stage during and at the time of the ratification of the international Convention went through several drafting efforts, to tailor Indian response to the international commitment. Even in its current form, the Bill has not addressed many of the local and national concerns.
6. The need to conform to the conditionalities of international financial institutions at times, activates the powers that be to go through the process of law making or effect amendments to the existing ones. The Draft Rules on management of Bio-medical Wastes, in 1995 and 1997 and the proposed Wildlife Protection (Amendment) Bill, 1997, are illustrations of this proposition, the formulation of draft national policy on rehabilitation of project displaced people and enactment of legislations by a number of States, in this regard, are also on account of the need to conform to the conditionality of the World Bank that the impoverishment risks of people displaced by Bank funded developmental projects should be minimized.
7. The current corpus of Environmental Law in India suffers from a multiple disability. It is myopic in vision, sectoral in approach and a knee jerk reaction to environmental problems. The Environment (Protection) Act, 1986, for instance, designed as an overarching umbrella legislation, to deal with every conceivable aspect of environment has, by and large remained a law regulating problems of pollution. Coming, as it did, in the wake of the mass disaster at Bhopal, the expectation essentially has been that this legal tool would help prevent and avoid such a calamity from recurring. No evidence exists, both in its substantive part

and in actual application, in about a decade and half of its working, that this law possesses the potentiality of meeting the challenges of mass environmental disasters. The ever-increasing number of rules and notifications under it, while giving the impression of broad-basing the ambit of the Act are, in fact, after thoughts to the legislative design rather than its integral part.

Piece-meal approach to environmental problems, predominate legislative effort. While we have legislations to control water and air pollution, atmospheric pollution gets less than peripheral consideration. Forests and wildlife get separate and independent treatment. A separate legislation on Geographical appellation of goods (including varieties of life forms) has recently been passed. Laws enumerating the rights of farmers and breeders are in the pipeline and the Bio-diversity Bill is awaiting parliamentary nod. None of these efforts have a holistic vision of environment and its management, nor would they endeavour to bring about coordination among various implementation agencies. Little realization exists that each of these legislative efforts are inter-related and that there is need for consultation and coordination among a number of ministries and implementation agencies to work together in finding legal solutions to the environmental problems in a concerted way.

Micro-planning, as a criterion to justify different standards for implementation of the law, is not something found natural or logical in the administrative process. Issuance of consent orders, without deeming it necessary to formulate and follow certain criteria for such a judgment, by the Pollution Control Boards, is not in common. Courts of law have been approached, seeking directions to be issued to the agencies of state to formulate zoning policies, to justify their action.

8. Policy and law-making is not always an open and transparent process. There is no culture of consultation and initiation of efforts in seeking opinions, critiques and comments to an intended piece legislation. Let alone the people who are most likely to be affected by the legislative effort, even the other sister departments in the government and line agencies would not normally have access to the "secret", "confidential" and "cabinet" notes, till they get presented on the floor of the legislature. While the Biodiversity Bill of 2000, went through over half a dozen drafting efforts, spread over seven long years, most of the forests and

wildlife departments in a large number of States, remained oblivious to what was happening around them.

Further more, as a matter of fact, the design and draft of policies and legislations evolve out of the bureaucratic stables, with the lawmakers having very little significant role to play in the entire process. Several bills are presented and rushed through the legislatures with the members devoting very little of their quality - time to deliberate, debate and decide on their contents and impacts. As if this is not enough, several ordinances get issued when the Parliament is not in session, to circumvent legislative scrutiny. Although, such a device would only be in operation for a short while, its impact lasts for a longer period. What remains a matter of concern is that many of these administrative actions exceed their brief of detailing mere administrative procedures, as they deal with substantive aspects of law, too. A fairly recent device employed by the administration is to circulate a note, in an informal way, among groups of people and when it generates much heat and resistance, append it the law as an aspect of its implementation. Should it evoke any adverse reaction, it would become convenient to disown it as being "nothing official about it"!

9. The evolution of environmental policy and law in India is on a parallel track to that of Constitutional evolution. They neither reflect the constitutional aspirations nor appear to conform to its commands. While the Constitution of India has been in dynamic ferment, keeping pace with the needs of changing times, in the fifty years since its inauguration, the whole body of environmental legislations is in a state of ferment displaying least dynamism. The Constitutional commands as to participatory environmental management in a spirit of cooperation and partnership between the State and the Citizens and vesting the local communities and the local government with the function of managing the local resources by ushering in a process of democratic decentralization of governance, have neither informed nor influenced the environmental legislative processes, in bringing a paradigmatic shift from the centralizing tendencies.

Antiquated laws continue to rule the roost. Legal foundations of every aspect of natural resource management are to be found in the efforts of our colonial masters. Some of them are so outdated that they are directly in conflict with the current environmental

legal regime. The Indian Easements Act, enacted in 1872, for instance, has a provision by which one acquires the right to pollute the neighbour's property! The objectionable provision is yet to come within the scrutiny of the legislature for the purpose of amendment. The Land Acquisition Act of 1894, which empowered the State to acquire private property for a public purpose, got amended after ninety years, to further strengthen the state to resort to such procurement even for a company (i.e., for a private purpose, too!). The Indian Forest Act, of Colonial Vintage (enacted in 1927), remains in the same shape and form, after over a half-century of our independence, while the forest cover in the country has recorded a sharp decline, during the period. Industry-related laws and the laws concerning Mines and Minerals, were all enacted, within a decade of our independence. Except for minor cosmetic changes, here and there, these continue to operate with little or no accommodation of current environmental concerns. These are only a few illustrations. But, these do indicate the fact that, while the laws enacted earlier, perhaps, served the purposes of the time when they were made, have failed to demonstrate the dynamism required to address the challenges to environment in the current context.

## 1.3 ENVIRONMENTAL LAW ENFORCEMENT

Environmental law enforcement, being a highly specialized area of implementation, entrusted to different agencies under different laws, presents a none-too-happy-a-picture. Lack or inadequacy of skill; less than satisfactory infrastructural facilities; poor and unimaginative understanding of the law; jurisdictional conflicts and lack of coordination, among different agencies of implementation, appear to contribute to poor and in effective implementation of the laws. Ability of some of the more resourceful industries in either camouflaging their violations and non-compliance and in exerting undue pressure on the enforcement agencies, also has contributed to the inefficiency of the enforcement apparatus.

Legislative efforts at pollution control in India date back to the mid-nineteenth century.Many of these Acts dealt with environmental regulation in a piecemeal manner and proved ineffective at reducing the levels of pollution. Action against polluters had necessarily to be initiated in courts by those affected. Pollution and environmental

degradation were addressed very generally in terms of nuisance, negligence, liability, and a few principles of tort law. The spate of legislations in the post-independence period also dealt only incidentally with pollution. Both air and water pollution continued to increase.

Perhaps inspired by the Stockholm Declaration of 1972, the Water (Prevention and Control of Pollution) Act, 1974 (the Water Act), provided for the institutionalization of pollution control machinery by establishing Boards for prevention and control of pollution of water. These Boards were entitled to initiate proceedings against nfringement of environmental law, without waiting for the affected people to launch legal action. The Water Cess Act, 1977, supplemented the Water Act by requiring specified industries

to pay cess on their water consumption. With the passing of the Air (Prevention and Control of Pollution) Act, 1981 (the Air Act), the need was felt for an integrated approach to pollution control. The Water Pollution Control Boards were authorized to deal with air pollution as well, and became the Central Pollution Control Board (CPCB) and the State Pollution Control Boards (SPCBs). The Bhopal Gas leak disaster of December 1984 precipitated the tightening of environmental regulation. In 1985, the Department of Environment was changed to the Ministry of Environment and Forests (MoEF) and given greater powers. The Environment (Protection) Act, 1986 (EPA), was passed, to act as an umbrella legislation. The Act also vested powers with the central government to take all measures to control pollution and protect the environment. The Environment (Protection) Rules, 1986 were subsequently notified to facilitate exercise of the powers conferred on the Boards by the Act. The EPA identifies the MoEF as the apex policy making body in the field of environment protection. The MoEF acts through the CPCB and the SPCBs. The CPCB is a statutory organization and the nodal agency for pollution control. The EPA in 1986 and the amendments to the Air and Water Acts in 1987 and 1988 furthered the ambit of the Boards' functions.

### 1.3.1 Constitutional Directives

In terms of constitutional provisions, the 42nd Amendment of 1976 for the first time imposed an obligation on the part of the state (Article 48A) and the citizens (Article 51A(g)) to endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country. The economic reforms of 1991, the Rio Conference of

1992, and growing environmental awareness all resulted in further amendments to the constitution.

### 1.3.2 Role of the Judiciary

The Supreme Court and High Courts have played an active role in the enforcement of constitutional provisions and legislations relating to environmental protection. The fundamental right to life and personal liberty enshrined in Article 21 of the Constitution has been interpreted by the courts to include the right to pollution-free air and water.

Also, relaxing the enforcement of strict rules of proof and modification of the traditional rule of standing (locus standi) so as to facilitate public interest litigations has served, more or less, to remove the difficulty in individuals approaching courts for redressal.

The backdrop of all this has been the growing environmental awareness among the public. This has been demonstrated by public demonstrations and protests throughout the 1970s and 1980s4, growth in environment and development oriented non-governmental organizations (NGOs), citizen groups, and pressure groups in India (today, roughly 20 times the size in 1985), and the increase in the frequency of public interest litigations.

### 1.3.3 The prevailing form of governance

From the characteristics of the pollution control mechanism in place in India, it can be gleaned that there exists a command and control regime with a set of laws designed to perform a preventive rather than a proactive role. Even the constitutional provisions, while affirming the right of the State and the duties of the citizens, do so without upholding the corresponding rights of the individuals and the duties of the state. In other words, citizens cannot claim environmental protection as a right and the state is not bound by any duties to protect the environment. It becomes evident that environmental policy and law in India has not evolved in anticipation of a problem, but rather has been a knee jerk reaction to existing problems.9 Judging by the prohibitive levels of pollution in existence today it has been ill equipped to achieve any of the targets specified. The EPA, for example, came into existence to deal with all anticipated environmental problems with the hope that mass disasters of the Bhopal variety are

prevented from recurring. In over a decade of its working, no evidence exists, both in its content and application, that this law has the potential to meet the challenges of mass environmental disasters. Central and state governments and the CPCB and SPCBs have adopted a soft attitude towards polluting industries and have done little more than issue warnings. The result is that these laws are practised more in violation than conformity and a large number of industries operate without proper safety and pollution control measures. For successful implementation of the CAC policy envisaged, certain facilities are of paramount importance. These are infrastructure of the regulatory agencies, a thorough understanding of environmental problems, and most importantly the monitoring and enforcement capabilities of the regulatory agencies. An evaluation of the PCBs, however, reveals that their working is rife with shortcomings.

### 1.3.4 Enforcement

The primary functional tool employed by the PCBs for controlling industrial pollution is inspection of polluting units. Given the penalties in force for non-compliance in India and keeping in mind the extent of the SPCBs' powers, the impact of inspections on compliance is only as strong as the threat of enforcement and punishment faced by the industrial units. Studies conducted reveal that there appears to be no impact of inspections on emissions. The reality is that environmental management often degenerates into crisis management. Inspections are undertaken at the time that operating consent is granted and thereafter usually only in response to complaints, accidents, or other emergencies. Enforcement by the PCBs, as a result, is woefully inadequate. Further, a study conducted by the Planning Commission found that they do not have a complete inventory of polluting and potentially polluting industries. Small industries (capable of high levels of pollution) have been left out of the purview, further undermining efforts at pollution control. Small industries are known to contribute as much as 40 per cent of air and water pollution.

### 1.3.5 Monitoring

Monitoring conducted by the PCBs is also far from effective. Polluting industries may make a one-time investment and set up Effluent Treatment Plants (ETPs). Around 2–5 per cent of its capital investment may be so spent on pollution control. The costs of operating these facilities are anywhere between 15–30 per cent of the investment made,

annually. As operating costs are high, industries are often reluctant to run these plants. Poor monitoring almost always allows units to get away without operating these plants properly. The PCBs claim that inadequate manpower limits their monitoring.

### 1.3.6 Jurisdictional Questions

A plethora of authorities enforce different aspects of environmental laws. While, the pollution-related laws are primarily enforced by the Pollution Control Boards and the forest-related laws by the Forest and Wildlife Authorities, the management of other aspects of environment are entrusted to a variety of agencies, to function in a cooperative way. The Rules under the Environment (Protection) Act, 1986, require a number of agencies of State that include, the Revenue, Transport, Local Self-Government and Industry, besides the Pollution Control Boards to work in unison to achieve the desired results. One of the rules of interpretation of statutes insists that whenever a number of statutes deal with the same subject matter, they ought to be harmonious construed as to ensure that each one would complement and strengthen the other and avoid any kind of overlaps in jurisdiction. But, in practical terms super egos and poor understanding of the law have come in the way of cooperation and complementarity in the functioning of different agencies. The snowballing of the avoidable conflicts of jurisdictional question have led to different agencies of state taking irreconcilable positions and we are witness to strange sights of cases fought by them over the issue, in the courts of law. The courts of law too, have not really helped in the matter, by handing down confusing and conflicting decisions that neither reflect the true spirit of the law nor state the correct legal position.

One of the most familiar and oft-argued jurisdictional issue, pertains to the authority of the general administration and that of the Pollution Control Board. While, the general administration has the power to deal with every conceivable aspect of public nuisance, the State Pollution Control Board is empowered to tackle pollution. The problem of conflict of jurisdiction is perceived when the general administration attempts to initiate action over polluting activities, as amounting to public nuisance and the Pollution Control Board also arrives on the scene to deal with pollution. No uniformity exists in pronouncements of the different High Courts in resolving the conflict of jurisdiction question. In the *Tata Tea* case, the Kerala High Court ruled against the

exercise of jurisdiction by the General Administration, when the State Pollution Control Board was seized of the problem. It opined that since the specific pollution-related laws were complete codes designed to prevent pollution, they impliedly repealed the provisions of S. 133 Cr.P.C., to the extent they relate to prevention and control of pollution. However, the Andhra Pradesh High Court, in the *Nagarjuna Paper Mills* case, took the position that the exercise of jurisdiction by the Executive Magistrate (District Collector), under Cr.P.C. does not conflict with the authority of the Specialized Agency (Pollution Control Board), as long as it did not interfere with an order of the latter. In a subsequent case, the Divisional Bench of the Kerala High Court adopted the view of its Andhra counterpart by overruling the *Tata Tea* decision.

The Karnataka High Court, in 1997, first chose to follow the *Tata Tea* ruling and later, the same year, quickly retreated to subscribe to the approach of the Andhra High Court. Perhaps, a more balanced position is taken by the Karnataka High Court which, in a later decision, found no conflict of jurisdiction between the two authorities and to construe the relevant legislations under which they exercise their respective power as complementary to each other. It also further clarified that in terms of functioning, the Pollution Control Board would, as a general rule, address itself to activities of greater complexity and of different magnitude (like industrial pollution), than minor and local instances of nuisance (like nuisance caused by a Poultry farm). The latter could, as a matter of fact and convenience, be addressed by the Magistrate under S. 133 Cr.P.C. upon a representation by an individual or a small group of people. Extending further this logic, it could be interpreted that the jurisdiction exercisable by the two authorities can be concurrent, complementary and cooperative. While the "nuisance" could be tackled to maintain health, hygiene, law and order by one authority (Executive Magistrate), the dimension of "pollution" can be handled by the specialized agency (Pollution Control Board). Since such a classification is neither made by any legislative enactment, nor by the pronouncement of the apex court, as yet, the final word in legal terms, as to the resolution of conflict of jurisdiction, has not been said.

### *Environment Management Service*

A comprehensive policy for environmental management, as would address and balance the imperatives for development and concerns for conservation, was evolved by

Government of India, in 1992. One of the major instruments for action, as stated in the policy document was, "to develop appropriate organizational structures and a pool of professional manpower to serve as the cadre for environmental management service". Nine years down the line, all that one could discern in the system of environmental administration are, the elevation of the Environmental Minister from being a "Minister of State" to a regular Minister of Cabinet rank at the Central level and specialized group of personnel occupying lower positions while the top management positions remaining with the Generalist, Indian Administrative Service, as always.

The hiatus between policy prescriptions and actual practice is never bridged. Professionalized environmental management service continues to remain on paper only.

***Untrained and Unskilled***

The environmental law enforcement agencies present a very disturbing picture. Trained and skilled personnel in law are in short supply. The Ministry of Environment and Forests, upon coming into existence two decades back, had a Legal Cell, with a Law Officer. The Cell does not exist any longer. The policy papers and legislative drafts are prepared either by non-law persons within the Ministry or by commissioning the services of experts from outside the Government. Although, the drafts get whetted by the Law and Justice Department, before getting tabled before the Parliament, it is done routinely like any other legal draft without bestowing any particular attention as the subject may demand. The Legal Department would rather pay greater attention to the form, structure and the technical aspects of the draft rather than to its substance. The Ministry at the Centre and at its regional offices is served by scientific officers and social scientists and presided over by senior bureaucrats drawn from the Central Civil Service, few of whom are trained in Law, much less in Environmental Laws. Another phenomenon, that is getting increasingly pronounced in the Environmental aspect of the administration is that the authorities at the policy-making level do not remain in the same position for long, as to understand the nature of work and acquire an in-depth knowledge over its functioning. Instances abound of the personnel in the higher echelons of the ladder of administration getting training (including a couple of stints abroad) in the environmental management systems and then moving over to the other departments. Very little scope exists for putting into practice, whatever expertise acquired by the authority by such training. Nor,

has there been a proper mechanism evolved to assess and account for such expensive investments.

While the Central Pollution Control Board (CPCB), at the Centre, is well served by a team of Law Officers, their role is confined to assisting and briefing the Private Legal Counsels, appointed for the purpose, after the dispute involving the government comes up before the Courts of Law. No system is evolved, as yet, to facilitate consultation, by the different branches within the Board, with the legal wing, before or at the time of decision-making by each one of them. No special care is taken in ensuring that the legal personnel recruited do possess the knowledge and skill required for understanding and interpretation of environmental laws. No regular, periodic, verifiable training programme is evolved to ensure that their capacity in Environmental Laws is enhanced, by the Board.

The story is no different in the regional offices of CPCB or in the State Boards. Not all the State Boards have legal officers and, even where they are there, their functions do not differ substantially from their counterparts in the CPCB. Since the State Boards are normally the ones, that are involved in the litigative process, the legal personnel recruited for the purpose are expected to possess the requisite knowledge and skill as to the procedural and substantive aspects of environmental laws. The expectations are belied as one goes through the litigation profile of different State Boards. The higher judiciary has, time and again, reminded the Boards about these lapses in their litigation. The Gujarat High Court, in *Gujarat Water Pollution Board* v. *Kohinoor Dyeing & Printing Works* insisted that the Board officers to take effective steps for the service of the summons upon the accused; prepare the case thoroughly ; resist adjournments; seek exemplary costs to deter the accused from adopting dilatory tactics and vigorously pursue appeals in the superior court.

Even the personnel who actually implement the law (like inspection, investigation, sample-taking, etc.) do not always observe the mandatory procedures prescribed. As a result, the Boards have cut a sorry figure, before the Courts of law, by losing out to the polluters, even when they had excellent case on their side. The *Delhi Bottling Case*, is an excellent example of this. A case that was not contested as to the claims of the Central Board, that the industry did not conform to the prescribed standards,

was lost on the technical ground by the governmental agency as it did not strictly observe the procedures prescribed under the Water (Prevention & Control of Pollution) Act, 1974.

**Budgetary, Infra-structural and organizational problems**

What appears like an abdication of responsibility by statutory agencies, in discharging the functions assigned to them, requires to be viewed in the light of severe constraints under which they work. Severe shortage of personnel and poor and inadequate budgetary allocations, appear to have contributed to their less than satisfactory administrative performance. Withdrawal of prosecutions without assigning reasons, launching prosecutions for pollution without verifiable standards or the instruments to test and convict the offender and routine and cursory inspections forming the bases for initiating real action, are mere indications of the malaise that has set in the system of environmental governance. With Boards in place without a recognized laboratory to analyze emissions and laboratories lacking in equipment to measure emissions, as it prevails in a number of States, one cannot expect the statutory bodies to give a better account of themselves than what exists now.

There has been considerable progress in evolving excellent policies in the last couple of decades. A number of legislative enactments, during the same period, have helped in the creation and expansion of the environmental administrative set-up. The plan documents (especially from the fifth five year plan onwards), have repeatedly stressed on making the environmental enforcement machinery more efficient and broad-based (including popular participation in the decision-making processes). Building of proper infra-structural facilities has been considered, in all these documents, essential for the administration to give a better account of itself. Translation of these into actual practice with adequate budgetary allocations and ensuring a well coordinated and effectively functioning machinery of implementation is yet to take place.

***Politicized, Bureaucratized and Lacking in administrative will***

Environmental Governance in India, like any other aspect of governance, as an idea and at the level of conceptions, made a promising beginning. After initially raising a lot of hope it has lost its way and got so bogged down in politics and administrative inefficiency that the common man got compelled to look elsewhere for overcoming the environmental problems faced by him. This can be illustrated by reference to the

National Committee on Environment Planning and Coordination (NCEPC). Following the observation made in the fourth five year plan document of the need to establish a national body to bring about greater coherence and coordination in environmental policies and programmes and to integrate environmental concerns in the plans for economic development, the NCEPC came into existence on 12th April, 1972, in the Department of Science and Technology. The national committee was intended to act as the advisory body to the Union Government on all matters concerning environmental protection and improvement besides planning and coordinating the working of different ministries concerning the subject. Initially, it was a fourteen members body having a large number of experts drawn from a variety of disciplines. The Fifth Five Year Plan (1974-79) insisted that the NCEPC ought to be involved in all major decisions concerning the industry, so that environmental concerns get duly addressed. The composition of membership got expanded from time to time (24 in 1977 and 35 in 1979). Each time there was an increase in numbers, the expert representation decreased! Over-bureaucratization, clash and conflict amongst various agencies represented and lack of consensus in the decision-making process, became the end result. Viewing the Committee as an unwelcome guest, absence of cooperation in its coordinated functioning and neglect by different departments of the government hit the final nail in the Coffin of NCEPC. The role of NCEPC in advising the Central Government and helping it to decide on the abandonment of the Silent Valley Project in 1983 (a project for damming the Kuntipuzha River in Kerala to generate electricity, that had the potentiality of destroying one of the richest biological and genetic heritages of the world, located in the Western Ghats) might, having the benefit of hindsight, have led the governmental agencies and the industrial lobby to view it as opposed to development. So it could have been that the body was viewed as an advisor not to be trusted or taken into confidence.

Constitution of core expert groups to advice the government on matters of policy and implementation of law, especially when faced with an emergency situation or in response to a directive from the higher judiciary, has become a routine affair. In certain cases, it might appear that such a formation, to be in deference to the wishes of the judiciary. However on closer examination it becomes evident that the entire exercise invariably has resulted in enabling the government to buy time, postpone decision-

making and when the reports are given, they remain at highest levels of abstraction as to become more of enunciation of principles and not real tools for better and effective implementation. The 1992 National Environment Policy Document and Pollution Abatement Policy Document of the same year, may be cited as illustrative of the fact of grandiloquent design, without much of a serious effort, at the implementational level, in giving effect to the hortatorial expressions in concrete terms.

Administrative high-handedness and non-observance of procedural formalities, in the implementation of the law, have often resulted in industries' getting away with violations. In the *Suma Traders* v. *Chairman, Karnataka State Pollution Control Board,* the Chairman ordered closure of the industry, on receipt and enquiry of the complaint received from the local residents against the air pollution caused by the food grain processing unit of the industry. The relevant provision of law, required exercise of power by one upon due delegation of authority by the Pollution Control Board. On being challenged that the Chairman did not have the power to issue such an order, as he was not so authorized by the Board (as confirmed by the Board), the court held that the impugned order of the Chairman was in clear violation of the provisions of law and amounted to abuse of power. The court went a step ahead, in ordering the Chairman to pay a penalty of Rs.2500, by way of costs.

Political interference in appointments and in the day-to-day functioning of enforcement agencies have come in the way of these institutions developing into professionally competent and efficient bodies. The very general nature of qualifications required for the membership of Pollution Control Boards, including that of the Chairman, have been taken advantage of by governments in making appointments in an arbitrary way. As a result of which it is not uncommon to find a political appointee presiding over the destiny of a specialized agency of State. There is this instance of a State Government going ahead with the appointment of a person as the Chairman of the State Pollution Control Board, mainly because the Chief Minister and the Minister of Environment and Forests of the State willed it that way. This was in spite of adverse remarks passed over the person in question by the authorities within the department and found unsuitable for the position by the Expert Committee, constituted for the purpose of making recommendations for the appointment of the Chairman. When this snowballed into a

case before the High Court, the latter issued strictures against the government for arbitrary exercise of power with a direction to make a suitable appointment in place of the incumbent.

Another factor that is responsible for the environment enforcement agencies being viewed in poorer light is the phenomenon of several major industries like, Coal, Petroleum, electricity, iron and steel, agro-chemicals and heavy industries in the near exclusive control of the public sector - Government - controlled, operated and managed enterprises - with heavy government representation in their Boards. Since the top brass of state administration occupy positions of authority in them, there is marked reluctance on the part of the enforcers of environmental laws, who, invariably occupy lower rungs in the echelons of administration, in displaying the required administrative will in bringing to justice the deviants in the public sector.

***Centralized and Non-participatory***

The major problem with the law and its implementation concerning the environment, is the tendency to centralize power of decision-making. This, as a matter of fact, has turned out to be inimical to good environmental governance. It is quite understandable if the policy-making power is centralized with an apex expert group. But, as a matter of fact, the problem lies in the bureaucratized structure that is at the helm of affairs in the form of the agencies of the Central Government, which has the final authority of deciding on all aspects of environmental management. While scope exists for the involvement of expert bodies in aiding, advising and to make recommendations, the Central Government is, in the existing scheme of things, neither under a compulsion to put into effect what it gets from expert advice, nor for that matter, under an obligation to give reasons as to why its decisions differed from the advice received by it. Rule-making, laying down procedures for implementation and the power to issue directions to protect, maintain and improve the quality of the environment are all vested in the Central Government.

Scope only exists in the law for delegation of powers of implementation as to different aspects of environmental administration. In making such a provision, care has been taken to ensure that the delegatee has to be nominated by the Central Government; the parameters of its functioning clearly spelt out by the latter and that would perform its

assigned functions, under the direction, authority and supervision of the Central Government. The Centralization of Power is so much that even the subordinate legislation under Environment Protection Act, framed by the Central Department of Environment and Forests, override any other Central or State legislation. The Central Government wields immense powers of decision-making as to every conceivable aspect of environmental management. Environmental clearance as to major developmental activities requires central clearance. De-reservation of reserve forest or use of forest land for non forest purpose is possible only with the prior approval of the Central Government. The current thinking as to administration of the pollution control regime, on the part of the Central Government appears to be in favour of arming the Central Pollution Control Board with many of the functions that are being exercised by the State Boards.

Some of the recent initiatives in decentralization by the Central Government have been less than sincere efforts in empowering the environmental administration at the grass-root level. The Joint Forest Management programme, for instance, enables the local village community to manage forest lands under the direction, supervision and authority of the forest department. It is more of a benefit-sharing arrangement, for the services rendered, in lieu of payment of wages for the labour. Developmental decisions affecting the environment are taken, both at the Central and State levels, by cursorily going through the processes of Environment Impact Assessment and Public Hearings. They are mainly aimed at going through the formality of giving some information to the local community of a proposed developmental activity and to hear their objections. No mechanism is evolved through these processes to ensure securing prior informed consent of the local community and making them participants and partners in the developmental process. Stakeholders' consultation and participation on matters affecting the environment, are yet to be practised. It is still very much a process of Government centred, centralized, environmental management. There is no guarantee that the objections raised by the local people in Public Hearings or even the concerns expressed at the state level administration would form part of decision-making at the Government level. The rationale for decisions about developmental projects is hard to find; in the rare case that it is isolated, it is not intelligently articulated. The arbitrariness of the entire

process becomes evident as a member of the Environment Appraisal Committee for River Valley and hydroelectric projects finds that there had been no single instance of withdrawal of environmental clearance for violation of conditions by a large majority of project proponents. Environmental governance, in the prevalent centralized system of management, has been anything but rational.

### *Poor Planning, Poor Maintenance of Records and Poor Vigilance*

Laws get enforced without the requisite preparation of planning, documentation and constant surveillance. Pollution Control Boards are, at times, guilty of issuing consent orders without prescribing norms or ensuring capacity to comply with standards. In a case decided by the Karnataka High Court, it was found that the State Board had granted consent for stone crushing operations without examining its potential for environmental damage. The consent order was challenged on the ground of the adverse impact of the operations on the health of the residents of the locality and the crops grown nearby. The court, through its direction, educated the Government about the need for immediate formulation of a policy and a plan of action to regulate the business and identify 'safer zones' for stone crushing operations.

The administrative machinery is guilty of poor maintenance of records. The official records, instead of being a fund of up-to-date information, remain indifferently maintained. Detailed information as to the nature of activity, kinds of discharges resulting from operations, safety and precautionary measures as to potential mishaps, instances of violations and actions taken do not even routinely find space in the Registers of the Pollution Control Boards. The series of orders passed by the apex court in *T.N. Godavarman Thirumukpad* v. *Union of India* exposed the ill-equipped feature of the forest and wildlife administration in the country. It brought to light the inadequacies in the official records as to various categories of forest and wildlife areas and the extent of encroachments in relation to them.

In the absence of making available information, on a regular basis, about different aspects of environmental management, the task of bench-marking or evaluating the potential and performance of different aspects of environmental management, the task of bench-marking or evaluating the potential and performance of different agencies of environmental administration is made all the more difficult. This also makes it difficult

for the ordinary member of the public to make use of the available avenues for seeking and securing environmental justice. For instance, the provision for the citizens' suit under pollution-control law enables an ordinary member of the public to complain to the agencies of enforcement about alleged violations of environmental regulations and expect timely action from the latter to set right the wrong. It also enables him to initiate legal action against the alleged offender, after sixty days of complaint, if no or satisfactory action is forthcoming from the agency of enforcement. This tool of empowering the citizen is blunted, if he cannot access and obtain reliable, authentic and up-to-date information from the records available with the environmental managers. Success in his prosecution is possible only if such information is forthcoming, as this alone is admissible in evidence in Courts of law. No other private arrangements, without authentication and certification by the official machinery will do, to bring to book the evader of law through the court process.

***Extremities in the Policies of Sentencing***

The sentencing policies under different environmental laws swing from one extreme to another - from being too liberal to the other extreme of being too exacting. Both have had negative impacts in terms of effectiveness of enforcement. At one end of the Spectrum are the pollution-related laws. The Environment Protection Act provides a fairly severe set of penal sanctions. The effect of this stringent regulation is both nullified and rendered redundant by another provision in the same Act which states that if any act or omission constituted an offence punishable under this law as well as any other law, the offender would be liable only under the other law and not under EPA. Both Water Act and Air Act provide for relatively lesser punishment for the same offence. The result is that the stringent penal sanction under EPA becomes non-operational.

At the other extreme are the penal provisions under Wildlife Protection Act, 1972. The rigour of the regulations and restrictions under the law are so severe that when once anybody gets booked for violations, it becomes almost impossible to secure acquittals. Since the law is stringent, the incidence of detection of crime and charging one for violation of the provisions and taking the route of courts of law for bringing the offender to justice are not a regular, everyday, routine occurrence. Even the courts of law expect strict compliance of procedures, adducing of evidences beyond a shadow of doubt and

resort to strict construction of the penal provisions. Thus the rigour of the law makes securing of convictions quite rare and even when the offences occur, they get underground or enjoy patronage of the mafia and corrupt administration. Little wonder that convictions for violations of the law, all over the country, are few and far between.

The foregoing depict the ground realities as to the limitations of legal facilitation for good environmental management and the inadequacies of the institutions and their personnel in effectively enforcing the laws. They also raise a variety of questions that directly concern the competence and the nature of functioning of the courts of law in dealing with intricate and complex environmental issues. Apart from addressing questions as to adequacy, appropriateness, limits and limitations of judicial intervention, there is also a felt need to explore supplementary and alternative mechanisms to ensure good environmental governance, in this part of the world.

## 1.4 POLICY INSTRUMENTS FOR CONTROLLING AIR AND WATER POLLUTION

### 1.4.1 Strategies for improving air quality

Despite of the current initiatives taken by the government and the concerned agencies, air pollution remains a major concern in most of the urban centres of the country. Besides continuing and consolidating the ongoing schemes/ programmes, new initiatives and definite strategies need to be developed and implemented for the betterment of urban air quality.

Vehicles contribute significantly to the total air pollution load in most of the urban areas therefore the sector deserves a high primacy in decision making. Pollution loads from transportation sector can be controlled mainly by controlling the number of vehicles on road and controlling the per unit emissions. The measures outlined below are imperative as well.

- Stringent implementation of regulations and providing incentives that will help in a shift from a greater reliance on private vehicles, to public transport system. The public transport system needs to be augmented to support such shift.

- Significant efforts should be there towards traffic planning and management in order to reduce congestion and streamline the movement on roads. Construction of express highways linking major urban areas needs to be given due priority.
- Mass Rapid Transport Systems could be considered for the fast expanding and major urban areas in the country.
- Euro I norms have been in place with effect from 1 April 2000 and Euro II norms will be applicable all over India from 1 April 2005. In case of the NCR (Natic al Capital Region), the Euro I and Euro II norms were brought forward on 1 June 1999 and 1 April 2000 respectively (CPCB 1999, SIAM 1999). Further tightening of the emission norms and their strict enforcement has to be ensured along with better fuel quality specifications.
- Use of alternative fuels such as CNG/ULSD (Ultra low sulphur diesel)/ LPG/Propane/ EV (electric vehicles) should be highly encouraged. The government needs to focus on studying the feasibility of different fuels, working on the mix of options for fuel use that meets stringent vehicular emissions criteria as specified by the regulatory bodies and the expansion of infrastructure to dispense these alternative fuels.
- Replacement of two-stroke engines.
- Strengthening of the I&M (inspection and maintenance) system, comprising inspection, maintenance, and certification of vehicles, is crucial for regulating pollution for the large number of vehicles in-use.

Additionally for the seventeen categories of large and medium scale industries and the large number of small-scale industries, the following may be viewed as necessary.

- Developing and promoting cleaner technologies with specific focus on waste minimisation and utilization technologies involving process changes, raw material substitution and improved housekeeping.
- Developing solutions appropriate for the level of operations in small-scale industries having neither the technological backing nor the financial resources for effective implementation. Thrust has to be on the development of appropriate

pollution control devices applicable in the existing conditions, in small and medium enterprises.

- Having databases on available technologies, their performance, sources and investments required, etc. Such databases need to be created, updated regularly, and widely disseminated.
- Strengthening the emission standards for various categories of industries and motivating a shift from pollution control to pollution prevention strategies.
- Locating high pollution potential industries/projects after considering the carrying capacity and the local environmental conditions of the region.
- To reduce air pollution loads from the power sector, clean technology options e.g. clean coal technologies, need to be adopted at the process stage alongwith putting in place the end-of-the-pipe options. Important strategy will be to shift to cleaner gaseous fuels.
- Additionally electricity pricing is an important policy in the long run to encourage demand-side management options as using more efficient energy appliances to reduce power consumption.

Besides strategies need to be developed to reduce the indoor air pollution by the use of improved smokeless stoves, better ventilation and increased access to clean fuels. Improved ventilation and improved biomass stoves are likely to be the most cost-effective options for short and mid term. But in the long term the option is to move up in the energy ladder from solid fuels to liquid and gaseous fuels for cooking. Kerosene, LPG, electricity, and solar energy are the potential and ideal options for long-term considerations.

**Alternative scenario – air quality**

Table 8 highlights the likely aggregate SPM emission projections under an alternative scenario marked with better fuels, efficient pollution control systems, greater transparency and with better institutions in place would assist in better performance as compared to the projected BAU scenario.

*Table 1 Projected SPM emission from all sectors (million tonnes)*

*Business As Usual (BAU) vs Alternative scenario(Alt)*

| Year | *Domestic* | *Transport* | Manufacturing | *Power* | *Total* |
|---|---|---|---|---|---|
| 1997 | 1 | 0.03 | 0.98 | 11.92 | 13.93 |
| 2025BAU | 0.65 | 0.12 | 2.23 | 5.27 | 8.27 |
| CAGR | -1.54% | 5.12% | 2.98% | -2.87% | -1.85% |
| 2025Alt | 0.435 | 0.057 | 1.931 | 0.211 | 2.634 |
| CAGR | -2.93% | 2.35% | 2.45% | -13.42% | -5.77% |

## 1.4.2 Strategies for water resource management and controlling water pollution

**Water resource management**

- The current approach to water-related matters restricts the issue only to political boundaries, involving number of agencies with overlapping responsibilities. This needs to shift to a river basin or sub-basin based approach for water management.
- The need is to develop surface irrigation sources and undertake measures for rainwater harvesting. Building appropriate water harvesting structures in the lower reaches to trap the run-off water is also desired to increase the overall resource availability.
- Efforts need to be intensified towards the conservation of water. Awareness generation towards recycling and reuse and developing cost-effective and efficient water appliances, would help in maintaining water as a valuable resource.
- Policy-level reforms need to be introduced in the current structure of subsidy and pricing of the rural electricity and agricultural water supply that encourages wasteful use of water.
- Promotion of traditional modes of irrigation and implementing the watershed approach will further enhance conservation and better management of water resources.
- Private sector participation at different stages of water supply, as well as better water pricing mechanisms ensure economic viability of operations. These would be beneficial in the efficient supply and usage of water in the domestic sector.

- To enhance the conservation and efficient utilisation of water in the industrial sector it is necessary to take a fresh look at the current shortcomings in the existing command and control regime, and motivate industries for voluntary initiatives like adopting tools for performance benchmarking, ISO 14000 standards and environmental rating.

**Water pollution control**

- To reduce the level of water pollution from the domestic sector it is essential to augment the existing waste water collection and treatment facilities and promote the implementation of decentralized waste water treatment plants. Possibilities of private sector participation, in different stages of wastewater collection and treatment, also need to be explored and implemented.
- Development and adoption of clean technologies especially for small-scale industries through appropriate economic instruments will help reduce the pollution loads from industrial sector.
- Innovative technological interventions are required for industries to undertake recycling and reuse of effluent water.
- Institutional mechanisms to address pollution in the agricultural sector need to be formulated.
- Use of bio-fertilizers needs to be encouraged and research activities in biotechnological pest control should be supported, to avoid pesticide-based pollution of water bodies.

**Alternative scenario – water resources and pollution loads**

Sectoral strategies for water with rational pricing structures, wiser resource utilization and better operational systems to collect wastewater and subsequent effective treatment thereafter, to check further resource degradation, would improve the existing scenario. The projected demand would go down by about 18% and with better tapping of the rain water resources, the gap between demand and supply would narrow, with a sustainable end insight. Table 2 projects the water demand levels and pollutant loads under the alternative scenario.

**Table 2 Projected total water demand (billion cubic metres) and projected pollution levels (million tonnes of BoD) Business As Usual (BAU) vs Alternative scenario (Alt)**

| Year | *Irrigation* | Domestic | *Manufacturing* | *Power* | *Total* | *BOD load domestic* | *BOD load industrial* |
|---|---|---|---|---|---|---|---|
| 1997 (BCM) | 528.85 | 23.52 | 1.6 | 1.39 | 555.36 | 3.75 | 0.406 |
| 2025 BAU | 789.50 | 39.76 | 4.79 | 3.75 | 837.80 | 6.58 | 0.007 |
| CARG-BAU (%) | 1.441 | 1.893 | 3.998 | 3.606 | 1.478 | 2.026 | -13.670 |
| 2025 (BCM) Alt. | 641.98 | 37.26 | 4.19 | 2.01 | 685.44 | 5.22 | 0.005 |
| CARG-Alt. (%) | 0.695 | 1.656 | 3.499 | 1.333 | 0.752 | 1.186 | -14.481 |

**Activity 1**

1. Discuss main elements of environmental law enforcement. What are the jurisdictional questions associated with enforcement of these laws?
2. Explain briefly the mechanism for environmental regulation in India.
3. give short notes on the following
   - Strategies for improving air quality
   - Water pollution control
   - Prevailing form of governance
   - Water resource management

## 1.5 SUMMARY

The rapid increase in population and economic development has led to severe environmental degradation that undermines the environmental resource base upon which sustainable development depends. To manage the environment protection a regulation mechanism is there in India which was discussed in detail in the unit. Environment protection laws and enforcement of these laws were discussed in the later sections. The economics of environmental pollution, depletion and degradation of resources has in fact been neglected as compared to the issues of growth and expansion. Some of the drawbacks of the regulation mechanism of environmental policy were explained in detail. Finally strategies to combat the problems of air and water pollution were discussed.

## 1.6 FURTHER READINGS

- Afsah, Shakeb, Benoit Laplante and David Wheeler (1996), 'Controlling Industrial Pollution: A New Paradigm', mimeo, The World Bank, Washington, D.C.
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- Steer, Andrew (1996), 'Ten Principles of the New Environmentalism', *Finance and Development*, Vol. 33, No. 4, 4–7. *The First Delhi Master Plan*, 1 September 1962.
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# UNIT 2

# FOREST MANAGEMENT AND SOCIAL FORESTRY

**Objectives**

After reading this unit, you should be able to:

- Understand the history of forest management in India
- Know the Indian forest policy and laws
- Appreciate the approach to people's participation in the management of forest and common land
- Know the approach to joint protected area management
- Identify the concept of social forestry and its benefits

**Structure**

2.1 Introduction

2.2 History of forest management in India

2.3 Forest policy and laws

2.4 People's participation in management of common and forest land

2.5 Joint protected area management

2.6 Social forestry

2.7 Summary

2.8 Further readings

## 2.1 INTRODUCTION

In India, forests are a main source of livelihood and income for some 315 million people, nearly one-third of the country's total population. The majority is very poor, and for a long time they were deprived of their rights and fair access to these natural resources. As traders and the government heavily exploited the forests, they became increasingly degraded. Animosity between local communities and the nation's forestry department was constant. Then, in 1988, a new policy made it possible for India's forests to be managed by the government and the people together. The result was the introduction of joint forest management in 1990.

Under the program, villages organize committees that work with government foresters to prevent or halt forest degradation in exchange for rights to non-timber forest products and a share of revenues from timber harvesting. Since its initial success in West Bengal, joint forest management has spread to 27 of India's 29 states and involves more than 63,600 village committees.

The Ford Foundation initially supported joint forest management in two states and later assisted the efforts of 25 non-governmental organizations to start a network for information exchange and policy advocacy. By the end of 1996, the network had grown to more than 150 members, ranging from nongovernmental, research and academic institutions to a few forestry agencies. The Delhi-centered network faltered, however, when pressed to respond to the demands of new members from all over the country. Also, the network had neither effective links to grass-roots institutions nor regular channels to forestry policymaking processes.

## 2.2 THE HISTORY OF FOREST MANAGEMENT IN INDIA

In pre-British India, forests were managed by native villagers or forest dwellers. Their control on forests ensured a free of cost supply of local fruits, vegetables, oils, nuts, meat, fish, animal products, fuel wood, fodder grass, medicinal herbs. In other words, they got everything they needed to sustain a comfortable living standard by managing the forests themselves. When British began to colonise India, they reserved large tracts of land for their personal use and for the overriding requirements of the British Empire. While doing so, they monopolised forests and made sure that the natives had no role in their management.

Force was used to strip the locals of their traditional rights to use forest resources. It began with the reservation of Malabar Teak for the Royal Navy in 1806. Malabar Teak was assessed as the most durable material for making ships. Later on, forests were cleared for constructing roads, lying of railway sleepers, building bridges and so on. India was a major source of timber supply during the Second World War. Finally, forests were cleared to enhance revenue-earning land. In fact, the basic purpose behind creating the Department of Forest as well as the Forest Research Institute was not to manage forests but to expand revenue from exploiting forest resources.

These objectives could not be met unless the British government asserted its power over forests to the exclusion of traditional users. In other words, the State had to monopolise forest resources and curtail traditional rights. This was achieved through the various Indian Forest Acts. The first of these was passed in 1865 enabling the British to acquire, demarcate and reserve forest area specifically for use in the railways.

This Act contained Section 8 that empowered the government to arrest without warrant anyone who encroached upon forest land demarcated for the purpose mentioned above. This Act was replaced by a new Act in 1878, which enabled the British to exercise absolute control over tracts demarcated as valuable. The British Government now argued that the rights enjoyed by villagers over forests were not rights. Rather they were privileges. Privileges may only be enjoyed at the mercy of the ruler. Since the British were now De Facto rulers of India, traditional privileges over forests could only be enjoyed at their mercy.

The 1878 forest act was modified from time to time until a comprehensive Indian forest Act was passed in 1927. This Act categorised forests into different classes. Each class implied a different level of State control over forests. The government could simply issue a notification acquiring a particular piece of land and designate it as a reserved or protected forest. This meant that all traditional rights over such land were automatically extinguished. Reserved forests could be converted into village forests. This implied that the lion had finished its feast and the remaining tit bits of meat were being thrown to the scavenger animals. Therefore, the villagers could now take what was left. Finally, the Government could prohibit animal grazing, mining and charcoal burning, stone quarrying practised by locals as means of livelihood by the villagers for ages.

After independence, policy and administrative structure for managing forests was kept on the same lines. The forest Policy Resolution of 1952 is based on a similar document adopted in 1894. The basic objectives of realising maximum annual revenue and making available maximum forest resources for defence, railways and other national objectives have not changed. Similarly, the tendency of asserting State rights and depriving local tribal of their rights has continued on same lines. The forest (conservation) Act of 1980 and its Amendment of 1988 were enacted with the basic

objective of transferring the power to utilise forests from the purview of State governments to the Ambit of the Union government.

Prior approval of the Union government must be sought before unreserving a reserved forest. Forests are still auctioned for felling. Locals continue to be deprived of their basic rights of collecting fuel, fodder and dry timber. The outlined objectives of maintaining 33 percent of total land area and 60 Percent of Himalayas under forest cover are far from being met.

## 2.3 FOREST POLICY AND LAW

India is one of the few countries which have a forest policy since 1894. It was revised in 1952 and again in 1988. The main plank of the forest policy is protection, conservation and development of forests. Its aims are:

i. Maintenance of environmental stability through preservation and restoration of ecological balance
ii. Conservation of natural heritage
iii. Check on soil erosion and denudation in catchment areas of rivers, lakes and reservoirs
iv. Check on extension of sand dunes in desert areas of Rajasthan and along coastal tracts
v. Substantial increase in forest tree cover through massive afforestation and social forestry programmes
vi. Steps to meet requirements of fuel wood, fodder, minor forest produce and soil timber for rural and tribal populations
vii. Increase in productivity of forests to meet the national need
viii. Encouragement to efficient utilization of forest produce and optimum substitution of wood and
ix. Steps to create massive people's movement with involvement of women to achieve the objectives and minimize pressure on existing forests.

As forestry has undergone many conceptual changes since the adoption of Indian Forest Act, 1927, it was decided to bring suitable amendments to this Act. The tenure of the Commission was extended upto 31st March, 2006.

A National Forestry Action Programme (NFAP) has also been formulated as a comprehensive strategic long-term plan for the next 20 years. The objective of the NFAP is to bring one-third of the area of the country under tree/forest cover and to arrest deforestation. Pursuant upon the recommendation made by the Indian Board of Wildlife in its 21st Meeting held on January 21, 2002 under the Chairmanship of Hon'ble Prime Minister of India, the National Forest Commission, with Justice B.N. Kirpal, ex-Chief Justice of India as chairman and six other members was constituted vide resolution dated 7th February,2003 of Ministry of Environment & Forests. After interacting with various stakeholders and State/UT Government, the Commission submitted its report to the Hon'ble Prime Ministry on March 28,2006.

The Report has 23 chapters, of which 20 chapters from 2 to 21, deal with various subjects like "Forest Policy", Legal Framework", "Forest Administration", "Personal Management", etc. However realizing the importance of specific issues, topics like "Forests of North East" "Agro Forestry and Social Forestry", "Forests in Natural Resources Accounting" and "Financial Support" has been dealt with in separate chapters.

There are 360 recommendations in the report. Action on these recommendations is to be taken by Government of India as well as State Governments. Some Salient features of the recommendations are as follows:

- No change has been suggested in NFP, 1988.
- Need to undertake scientific research to assess the optimum forest/tree cover according to forest type and topography to meet the intended objectives has been emphasized.
- Mendment of Indian Forest Act, 1927.
- Forest Department should implement the Biological Diversity Act, 2002 and Environment Protection Act.
- No amendment and further dilution to Forest Conservation Act, 1980.
- Re-scheduling of species under Wildlife Protection Act to avoid man-animal conflict etc.

## *Integrated Forest Protection Scheme*

The IFPS has been formulated by the merger of two schemes of the 9th Five Year Plan viz. 'Forest Fire Control and Management and 'Bridging up of Infrastructural Gaps

in the Forestry Sector in the North Eastern Region and Sikkim. It is operational from 2002-03. The scheme covers all the States and UTs for the 10th Five Year Plan period. The Central Sector Component of the scheme is implemented by the Ministry in association with other organizations.

## Wildlife

The National Wildlife Action Plan provides the framework of the strategy as well as the programme for conservation of wildlife. The first National Wildlife Action Plan (NWAP) of 1983 has been revised and the new Wildlife Action Plan (2002-2016) has been adopted. The Indian Board of Wildlife, headed by the Prime Minister, is the apex advisory body overseeing and guiding the implementation of various schemes for wildlife conservation.

The Third meeting of the National Board for Wildlife was held on June 19, 2006 under the Chairmanship of Hon'ble Prime Minister. The important decisions taken during the meeting include an alternate home for lions; survey for assessing the current status of peacocks in the country; preparation of an action plan for conservation of the red jungle fowl; identification of wetlands outside the Protected Area system for conservation etc. The Wildlife (Protection) Act, 1972 was amended in 2006 to incorporate the creation of the National Tiger Conservation Authority. The amendment was notified on September 4, 2006. The first meeting of the National Tiger Conservation Authority was held on November 6, 2006.

Project Tiger was launched in 1973 with a mandate to conserve tigers in a holistic manner. Its mandate was to be fulfilled by facilitating focused, concerted management of ecotypical reserves in various sates, constituted on a core-buffer strategy through funding the technical support including site-specific inputs to elicit local community support for conservation. The Project has been successfully implemented and at present there are 28 Tiger Reserves in 17 States, covering an area of 37,761 sq. km. This has now been renamed as the National Tiger Conservation Authority. Under the Project Elephant, which was launched in February 1992, States that have a free-ranging population of wild elephants are being given financial as well as technical and scientific assistance to ensure long-term survival of identified viable populations of elephants in their natural habitats.

Twenty five Elephant Reserves were notified by various state governments and consents were given for three, Baitarani and South Orissa in Orissa and Ganga-Jamuna in UP. The Central Zoo Authority (CZA) was created by the Government through an amendment of Wildlife (Protection) Act in 1992 to enforce minimum standards and norms for the upkeep and healthcare of animals in Indian Zoos and to restrain mushrooming of unplanned and ill conceived zoos that were cropping up as adjuncts to public parks, industrial complexes and the wayside.A national policy on zoos prepared by the Authority provides appropriate directions to the Government and other zoo operators.

The Animal Welfare Division became a part of the Ministry of Environment of Forests in July 2002. Earlier, the Division was under the Ministry of Statistics and Programme Implementation. The mandate of the Animal Welfare Division is to prevent the infliction of unnecessary pain or suffering on animals. The main task of the Division is to implement effectively the various provisions of prevention of Cruelty to Animals Act, 1960. Under this Act, a number of Rules have been framed for various purposes.

A National Institute of Animal Welfare (NIAW) at Ballabhgarh, Faridabad has been established to impart training and education in animal welfare and veterinary science. The institute aims at creating an enabling environment for the fulfillment of statutory requirements under the Prevention of Cruelty to Animals Act, 1960.Animal Welfare Board of India (AWBI) is a statutory body under Section 4 of the Prevention of Cruelty to Animals Act, 1960 with its headquarters at Chennai. Its basic mandate is to advise the Government on animal welfare issues, and create awareness regarding animal welfare. AWBI gives financial assistance to the eligible Animal Welfare Organisations for Shelter Houses, Model Gaushalas, for setting up Bio-Gas Plants, Famine/Drought Relief, Earthquake Relief, etc., in the various states.

## 2.4 PEOPLE'S PARTICIPATION IN THE MANAGEMENT OF COMMON AND FOREST LAND

Many people of a great variety of cultures and land-use practices live in or around tropical forests. Although these people are all in some way dependent on forests, they have little else in common. In recent years, however, it has become much harder for

forest-dependent people to use local forests and their products, owing to deforestation, logging, population pressure or legal initiatives such as the declaration of state forests, national parks or wildlife reserves. In many countries, plans to protect forest ecosystems have failed to address the needs and knowledge of local forest-dependent communities.

In forest conservation, participation is often associated with community forestry, which refers to forest management or co-management by people living close to the forest. Legal, political and cultural settings for community forestry vary widely, and the term covers a wide range of experiences and practices. Community forestry is often associated with South and Southeast Asia, but it is also common in other regions .

Although local participation is important in forest conservation, there are circumstances in which it is absolutely necessary, for example high population pressures and resource use conflicts, communal ownership and in smaller and more vulnerable protected areas. In such cases, conservation without local participation is doomed to failure. Nevertheless, participation in itself provides no guarantee of success. The outcome of participatory processes often depends on additional factors such as institutional or legal frameworks, and the education or interests of local people and other stakeholders. As the case studies in this paper show, governments and their agencies play a significant role in participatory processes by providing-or not providing-an 'enabling environment'.

## What is participation?

The concept of participation originally grew out of radical criticism of mainstream development projects in the 1960s and 1970s. Critics who asked why development projects often failed to meet their objectives came to the conclusion that a lack of participation was the reason. Too many projects, they argued, were designed and implemented without consultation or cooperation with the people whose lives they affected. Since then, participation has become one of the buzz words of development. It now seems that every project description or plan adopts a 'participatory approach', often because this is required by donor organizations for political reasons. Unfortunately, project planners and implementers frequently use the word 'participation' while continuing a traditional style of management that does not involve local people (Wily

1997). Nevertheless, true participation may lead to more effective conservation of forest resources (Box 1).

decentralization process is the Kayan Mentarang National Park in Indonesia (Box 2).

***Box 1. Joint forest management in India.***

About half of the states in India have endorsed a strategy of joint forest management (JFM), in which forestry departments and communities jointly manage forests and share rights and responsibilities. The idea of JFM originated from the management of sal (*Shorea robusta*) forests in West Bengal. Here, community involvement had a remarkable effect on the rehabilitation of degraded sal forests. Landsat images have shown that the area of closed sal forest increased from 11% to 20% in Midnapore District alone, and that many square kilometres of degraded scrub forest have been restored to open forest.

Encouraged by this success, the Indian government expanded the programme during the 1990s. Under JFM, the ownership of the land remains with the government. Village committees, who are the co-managers, are entitled to the benefits from forest products. Forest protection committees control access to jointly managed forests. These local institutions are demonstrably more effective in protecting forests than the state forest departments.

The JFM strategy has required a change of attitude from both forest departments and rural communities. Rural communities have had to organize themselves in new ways, overcome village and inter-village conflicts, and work together with forestry officials. Foresters have had to communicate with local people and share the responsibility for decision-making. To facilitate this process, the Indian government has provided legal and institutional backing, including land reforms, social forestry programmes, sharing of user rights with local people and educating foresters in participatory processes.

A key lesson of the JFM experience in India is that involving local communities in forest management can lead to more effective forest protection. Another lesson is that successful conservation depends on cooperation from local people and forestry officials, and on legal and institutional backing from the State.

Source: Based on Singh (1996).

When developers and conservation planners use the term participation, they often mean very different things. Adnan *et al.* (1992) have defined three basic meanings of participation:

i) Participation is a process in which information on a planned project is made available to the public. This type of participation often involves only community leaders. These people are consulted but decision-making power rests with external planners and project implementers.

ii) Participation includes project-related activities and not merely the flow of information. These might involve community labour or a longer-term commitment by local groups to maintain services or facilities, or even to plan for their future use. Although involved, people are not in control.

iii) Participation means that a project is a direct outcome of people's initiatives. A famous example of this is the Chipko movement, which began in the Himalayas in the 1970s when local women mobilized themselves to protect trees that were vital to the local economy (Shiva 1988).

Of course, we find many intermediate forms between these three categories. Some people have even claimed that participation has become a meaningless term, too often used to disguise continued top-down planning (Rahnema 1992). Others have argued that it is unreasonable to describe a process as participatory if local people are merely asked to supply information or labour to a project already designed and decided by planners (Gardner & Lewis 1996). Following these arguments, we only consider participation as genuine if local people are involved in the planning, organization and decision-making of a project from the outset.

## Participation as a social process

If effective participation in conservation means involving people throughout the organization and decision-making processes, how can we promote this kind of participation? To begin with, it is helpful to think of participation as a process. Participation means communicating and working together with different people and groups in order to achieve common goals. Participation also means learning from each other's knowledge and mistakes. It is a series of steps or phases, each of which presents new insights and challenges.

Participation is sometimes difficult but the rewards of truly participatory processes can be impressive, particularly if forests are conserved effectively (Lutz & Caldecott 1996; Wily 1997). Conserving forest resources requires that stakeholders trust one another and commit themselves to sustainable forest use. Legal or administrative procedures may have to be reformed or power redistributed to build relations of trust. Mutual trust often takes time to develop, especially if stakeholders have no previous experience of sharing decision-making or management responsibilities. It is the concrete

actions taken by stakeholders in relation to each other-rather than their words or promises-which ultimately determine whether trust will evolve or not.

It is important to consider how the conservation process itself may or may not help to catalyse relations of trust and commitment between stakeholders. An ambitious timetable of limited duration for a given conservation activity may, for example, make it difficult to ensure the trust and commitment of all stakeholders. This is often the case if conservation activities involve external personnel.

Such projects are often expected to last only a few years before the 'outsiders' leave. If local people have no previous experience of participating and cooperating, or if their tenure rights are not secure, the process of building trust and commitment may take much longer than permitted by such a timetable. Similarly, if project personnel depart before the positive effects of conservation activities become visible to local stakeholders, the latter are less likely to remain committed to the conservation process.The preference of donors for large-scale rather than small-scale projects can also inadvertently create barriers to trust and commitment. This is especially true if project managers (be they local people or 'outsiders') want other stakeholders to commit themselves at a level beyond their capacities and aspirations. Such an approach can make other stakeholders insecure, leading to minimal commitment or no involvement at all. To avoid such situations, stakeholders must be allowed to commit themselves gradually, task by task, and to build up relations of trust in a progressive manner.

## The participatory approach in conservation of forest genetic resources

No two participatory processes are identical, because people, forests and other circumstances vary from place to place and from time to time. Most participatory processes, however, involve a number of similar steps or phases (Figure 1):

**Step 1.** The first step is to identify objectives, including the priority species and areas to be protected. It is debatable whether this activity can be genuinely participatory because conservation objectives tend to be defined, at least initially, by government officials or scientists. There are cases, however, such as the Chipko movement and the South Pacific Biodiversity Conservation Programme, where people have defined their own conservation goals, which were then brought to the attention of government. Whether or not the initial formulation of conservation objectives comes from government

planners or local groups, it is important that these objectives remain open to discussion and reformulation once other stakeholders become involved in the planning process.

**Step 2.** The second step in conserving forest genetic resources is to identify suitable sites. Like step one, this phase may not always be participatory in the true sense of the word. If government planners make the initial site selection, for example, it is crucial that other stakeholders are able to challenge or change this decision later on.

**Step 3.** The third step is sometimes referred to as an interest-holder or stakeholder analysis (see Grimble *et al.* 1995; Danida 1996; also Table 1). In this phase, several questions must be addressed:

- Who will be affected by conservation activities?
- What are their interests?
- Who has a right to participate?
- How do different stakeholders affect the conservation area?

It is important to bear in mind that people's interests in a particular species or forest area are often more than financial. Trees and forests also have cultural, spiritual, recreational and aesthetic values. Depending on how they feel towards conservation activities, different stakeholders may want to participate in different ways.

If a group of people or a local community is defined as one stakeholder, it should be remembered that not all members of this group will share the same interests. Furthermore, in most countries, many different government departments and agencies are involved in land and forest management. These institutions often have divergent objectives and interests, and are best regarded as separate stakeholders (Table 1).

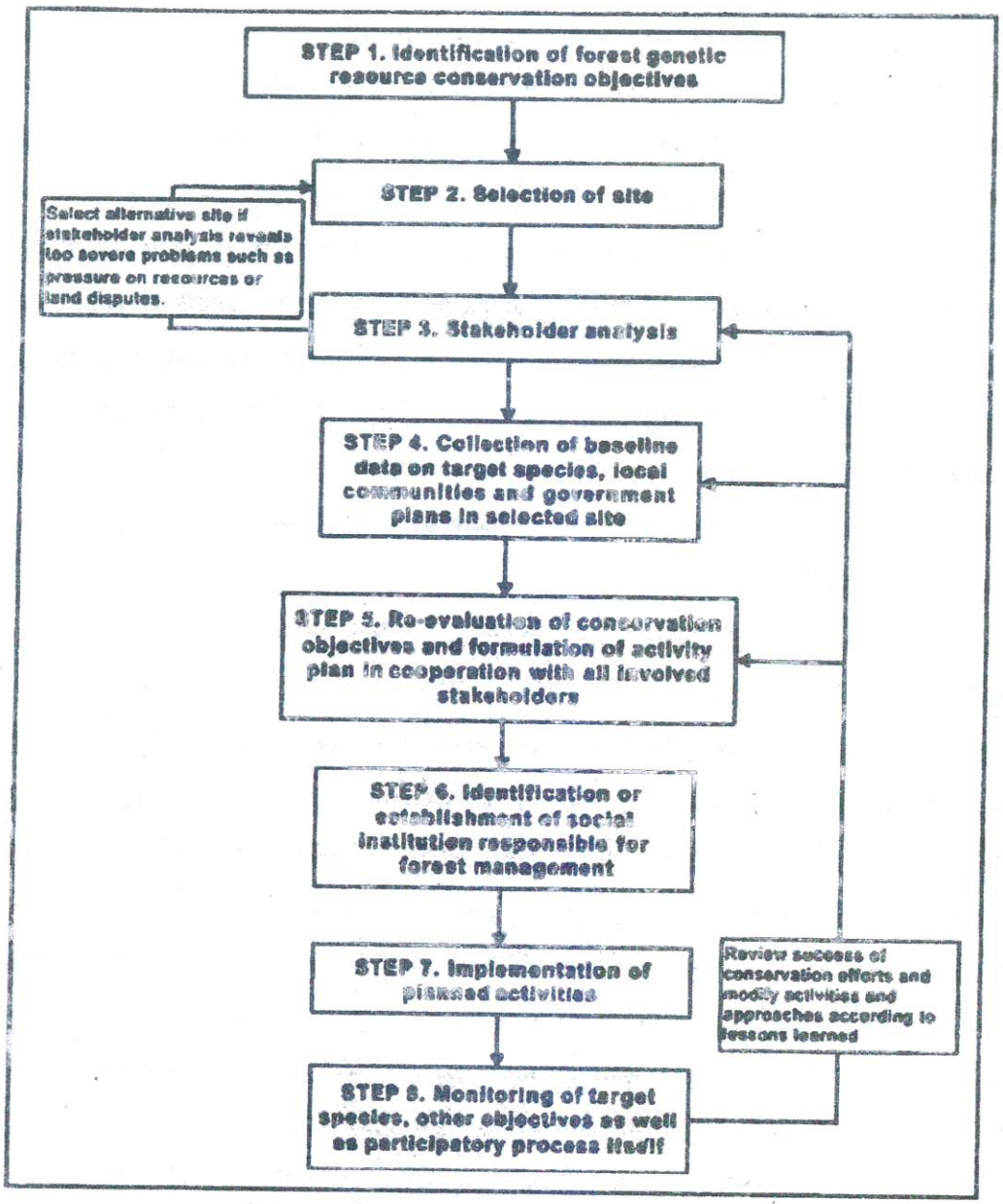


**Figure 1 A model participatory process for conserving forest genetic resources**

**Step 4.** The fourth step in the participatory process is to collect baseline data on the selected site. At least three different types of data are necessary: i) government policies and plans regarding the sites proposed for conservation; ii) data on and from local communities; and iii) data on the forest genetic resources. Ideally, a team of professionals and other stakeholders, including members of local communities, should work together to collect baseline data.As already noted, different government agencies may hold authority in a particular area and their plans for that area may not be

compatible. For example, a forestry department may plan to protect a forest area while another government department may plan to build a road in the same area. It is crucial for planners to know whether existing government plans will conflict inadvertently with conservation objectives. If this is the case, alternative conservation sites must be considered unless other government departments are willing to change their plans.

***Table 1. Stakeholder analysis, Khong Chiam in situ conservation area, Thailand***

| Stakeholders | Interests | Activities | Influence on forest genetic resources |
|---|---|---|---|
| **Local villagers** (Long-term residents, recent immigrants and forest users) | Food | Harvest of subsistence food sources (including nuts, fruits, tubers and fungi) | Minimal impact |
| | Timber | Harvest of timber for construction and other purposes. | Threat to preferred species |
| **Medicinal plant harvesters** | Medicinal plants | Harvest of leaves and bark for traditional medicines | Very limited impact |
| **Resin tappers** | Resin | Tapping of dipterocarps for resin production | Limited impact |
| **Fire-stick collectors** | Fire-sticks | Harvest of *Pinus merkusii* sticks for sale | Major impact that threatens *P. merkusii* |
| **Charcoal producers** | Charcoal | Cutting of timber for making charcoal | Threat to preferred species |
| **NGO** | Forest conservation | Public education | Maintain genetic resources through use |
| **Nature Care** | Well-being of local villagers<br>Equal benefit sharing | | |
| **Government**<br>In Thailand, 19 different government departments and agencies are involved in land management, including: | | | |
| **Royal Forest Department (RFD)** | Forest management and conservation<br>Research | Enforcement of forest laws and regulations<br>Research | Conservation of forest genetic resources *in situ* and *ex situ*<br>Programmes of domestication and improvement for priority tree species |
| | Pilot area in partnership in conservation | Workshops with local people | |
| **Provincial government** | Development | Local infrastructure and provision of government services | Various impacts, often negative, depending on activities |
| **Donor Project FORGENMAP/ DANCED** | Conservation of forest genetic resources and ecosystems<br>Pilot area in partnership in conservation | Training of RFD staff<br>Seed supply<br>Workshops with local people | Conservation and improved use of forest genetic resources |

**Step 5.** After all stakeholders have been identified and baseline data collected, a meeting of stakeholders should be held to re-evaluate the conservation objectives. Specific conservation activities, timetables and resources should also be defined at this stage. If conservation sites and objectives have already been selected by government officials or other conservation planners, it is crucial that hitherto uninvolved stakeholders are included in this stage of the conservation process. True participation means more than simply being informed about other people's decisions. It means having the opportunity and power to change these decisions and, perhaps, to add new goals to the agenda.

**Step 6.** In this step, the social institution responsible for implementing and monitoring conservation activities is identified or established. In some cases, appropriate institutions may already exist and can take up such responsibilities. In other cases it may be necessary to establish a forest management committee or similar institution. It is important to ensure that the social organization of a conservation project is decided before specific activities are undertaken.

**Steps 7 & 8.** These are the implementation and monitoring phases. During these phases, a conservation project will develop and mature as various activities progress. Implementation of activities or monitoring of target species and the social or political aspects of the conservation process will automatically lead back to previous steps in the participatory process. It may be necessary to carry out a new stakeholder analysis if new groups appear or if existing groups acquire or lose interest in a particular species or geographic area. Similarly, stakeholders may wish to revise or augment the baseline data at any time during a participatory process. The need to re-evaluate goals or activities may also arise. Projects must be designed with a high degree of flexibility to accommodate such changes. Implementation and monitoring should also be participatory.

- **Local communities and local people**

In conservation projects, villages or local communities are sometimes identified rather broadly as a single stakeholder. It is important to question this assumption and others about local communities. Some frequently held assumptions are:

- **Local communities are homogeneous entities.**

In terms of land holding, power, and knowledge, most communities are characterized more by their differences than their similarities. Women and men may

have different interests in a forest. Landless people may desire access to the forest and its resources for other purposes than landholders. If only community leaders (who are usually male landholders) are involved in a participatory process, other interest groups within the community risk being neglected. A common source of conflict is the failure to consider the views of all community members.

- **Local communities live according to stable traditional values.**

The idea that rural communities do not change or acquire new knowledge, habits and interests is wrong. Social and cultural traditions change as people are exposed to new options, ideas and technologies.

- **Local communities depend on the forest for their livelihood and therefore have an interest in protecting it.**

It is true that many people living in tropical forest areas are highly dependent on forest resources. In many countries, however, infrastructure development and access to urban labour markets have reduced local dependence on forests and forest products.

- **Local people like the forest and therefore want to protect it.**

Cultural perceptions of forests differ from group to group and from country to country. Many social groups have ways of thinking about and acting towards forests which may seem unintelligible or conflicting to outside observers. For example, although people may 'like' and value forests for providing fuelwood, food, medicine or timber, they may at the same time associate them with negative meanings. In Southeast Asia, for example, the forest has traditionally been perceived as the sphere of uncivilized and immoral beings such as spirits, wild animals and ethnic minorities. Thus forests are linked to notions of backwardness and danger, and have negative connotations for many people in this region (Davis 1984; Stott 1991; Isager 2001). People may be keen to clear forests and expand agricultural production, an activity which may be seen as more civilized and desirable.

- **Local people destroy the forest because they do not care about it.**

This assumption is almost as common as the previous assumption. Both ideas rest on the incorrect notion that people's perceptions and feelings about forests are straightforward and unambiguous, and cause them to act in well-defined, predictable

ways. In reality, people's knowledge (e.g. of forests), and the relationship between their knowledge and their actions, are highly complex and oversimplification should be avoided (see Bourdieu 1990 and Barth 1993).

- **Local people have a detailed knowledge of their environment.**

This assumption is as common as the counter-assumption that local people's knowledge about forests and biodiversity is irrelevant to conservation planners . In fact, forest dwellers do have considerable knowledge of forest resources and ecology. Government planners or external advisers often underestimate this knowledge. At the same time, however, it should not be assumed that all people labelled as local or indigenous have in-depth knowledge of their natural environment.

- **Local people practice superior forms of landscape management.**

Some groups have developed remarkably precise landscape management systems. Recent studies of indigenous forest management systems have shown that they can retain 50-80% of the biodiversity found in neighbouring natural forest ecosystems (Lawrence *et al.* 1998, cited by Poffenberger 2000). Such examples notwithstanding, traditional management systems have often been sustained in the past not by ecological considerations but by low population pressures, geographic isolation and a lack of modern technology and machinery (Ellen 1986; Milton 1996). Local or indigenous people's knowledge should not be idealized and it should not be assumed that their knowledge or culture alone has sustained their management systems. Rather, traditional management systems should be assessed together with local people to determine which aspects can be most effectively incorporated into conservation efforts.

## How governments create an enabling environment

Top-down conservation management is seldom effective, except where large budgets are available for enforcement and the society concerned is willing or forced to accept an undemocratic conservation process (Lutz & Caldecott 1996). However, without government support in the form of law enforcement and cooperation between different governments agencies, such improvements in local forest management are unlikely to be sustained (Tyler 1999). Attention must be paid, therefore, to the crucial role of government action in participatory conservation processes.

A government can provide an enabling environment for participatory forest conservation through: i) decentralizing political, fiscal and administrative power; ii) securing land tenure and user rights for involved stakeholders; and iii) education and other forms of capacity building. These aspects are discussed in the following sections.

***Decentralization***

One form of decentralization or power transfer occurs when specific stakeholder groups, rather than government officials, are given the right to collect revenues and decide how they will be spent. Such autonomy is the key to the strength of the joint forest management areas in India where local communities can retain all or part of the revenue from forest products (see Box 1 above). In Nepal, the government has granted rights of use and management to many local forest user groups. This decentralization of power has had promising results in terms of both forest protection and local people's willingness to participate in communal forest management and develop their management capacities (Tumbahanphe 1998).

The experiences in countries where new rights and responsibilities related to conservation have been given to local government units and non-governmental organizations suggest that there are both opportunities and potential problems (Lutz & Caldecott 1996). Poorly planned and implemented decentralization can give power to local societies that lack the skills and accountability to use it 'properly'. Decentralization may also lead inadvertently to a situation where the costs of biodiversity conservation are borne locally, whereas its benefits accrue at regional, national or global levels. One example of a successful decentralization process is the Kayan Mentarang National Park in Indonesia (Box 2).

***Box 2. Biodiversity conservation by indigenous people.***

Local Dayak communities and WWF Indonesia have worked together for some years in the Kayan Mentarang National Park in Kalimantan, Indonesia. Their aim has been to develop a plan for community-based management of the park. This plan has now been submitted to the Indonesian government, and it is hoped that it will be endorsed and implemented in the near future.

In 1992, the Dayak people of Kayan Mentarang began to map their communities on an experimental basis, aided by WWF Indonesia. In 1996, the Indonesian government agreed to change the status of the Kayan Mentarang area from a strict nature reserve to a national park. Subsequently, the status of the Dayaks was changed from illegal settlers to communities that could be legally involved in the

management of the area.

Encouraged by the government decision and the support from WWF Indonesia and the Indonesian Agency for Nature Conservation, the Dayaks conducted an extensive mapping of their natural resources in 1997-98. They drew detailed maps of the flora and fauna in their area, showing where they collected plants or used trees, which areas they cultivated and where their traditional hunting grounds were located. Using participatory rural appraisal (PRA) techniques, WWF personnel helped the communities to document information about their land-use systems, historical trends in resources, traditional forest regulations and knowledge on forest resources. All of this information was used in the development of the management plan for the national park.

Kayan Mentarang provides a good example of participation as a continuing process in which each party is obliged by circumstances to be flexible and accept new ideas. The Indonesian government accepted changes to create an enabling environment. The boundaries of the national park were redefined to accommodate the Dayak villages and their rice fields outside the park. It is hoped that the Dayak's traditional rules of forest management will eventually be recognized.

Sources: Worm and Morris (1997); Eghenter (2000); WWF (2000).

### *Land-tenure security and user rights*

The lack of secure land tenure or forest user rights is a key reason why local people do not commit themselves to participatory forest conservation. People without such rights face an uncertain future and are less willing to invest their labour in conserving forests. Once local people gain land or user rights, however, they often become interested in forest conservation. Granting such rights, however, can be a highly controversial move. This is partly because user rights themselves provide no guarantee that 'new' private or communal land owners will manage forest resources in more sustainable and socially accountable ways than governments. There are discouraging signs from the states of northeast India, for example, where most forests are owned by tribal peoples. These states have had the highest deforestation rates in India during the past few years. Analysis of these cases has led to the conclusion that joint control and management by the government and local people is possibly the optimal formula for conservation (Singh 1996). This conclusion is reinforced by Hirsch *et al.* (1999), whose study in Lao PDR demonstrated that a community cannot alone implement or enforce sustainable natural resource management without the legitimate sanctions set by government.

### *Capacity building and participatory approaches*

The case studies presented in this paper all show that participation entails changing social relationships, redistribution of power and new responsibilities for all parties involved. Often, these changes create a need for new skills, new ways of thinking and new ways of organizing. A participatory process inevitably involves different kinds of challenges for different stakeholders. Communities often need to strengthen their organizational capacity in order to reclaim responsibilities for managing and conserving forest genetic resources (Box 3). This may include developing competence in areas such as keeping records and minutes of meetings, or mastering certain technical aspects of forestry and conservation. Communities that acquire user rights over forest resources and start income-generating activities need to develop skills in accounting for and sharing benefits.

***Box 3. Participatory land use planning in Thailand.***

Sam Mun is an integrated development project in northern Thailand. The project has four development components: local administration, social and economic development, natural resources management and drug control. The project involves 60 villages of about 12,000 people from five ethnic groups, and covers an area of 18,000km$^2$ in five districts and two provinces. Substantial parts of this area are under three overlapping protected area regimes (watershed protection, national park and wildlife sanctuary), and are managed by the Royal Forest Department (RFD). Technically, the communities in this area have no legal right to live there.

Soon after the project was initiated, a tripartite institutional model was set up to combine the efforts of Chiang Mai University, the communities and RFD. Since then, capacity building has been a key objective of the project. The University and RFD have collaborated closely at both national and regional levels. The University provides technical support for research, information and training systems. Its main task has been to develop tools for RFD to understand and incorporate local culture and knowledge into watershed and forest management.

The project has experienced rapid social change and has had to change and improve its methods regularly. Stakeholders have been involved in continuous training. A general principle in Sam Mun is that information should be made accessible to all parties. In practice, this requires a simplified form of information that is highly visual in nature. For example, three-dimensional models of watersheds have been used to assist community members in expressing their ideas. Scientific language is avoided in favour of local names and meanings.

In Sam Mun, ethnic communities jointly manage watersheds with different government agencies.

The communities have gradually improved the condition of these watersheds, thus rendering strict enforcement of regulations or community resettlement unnecessary. The project has allowed many ethnic groups to maintain their traditional land use systems within the protected areas. In some subdistricts, the proposals of local watershed network committees have been incorporated into subdistrict development plans. Capacity building among government agencies and local groups alike has been the key to establishing mutual understanding and collaboration among various stakeholders.

Source: Uraiwan (2000).

A major challenge for government agencies such as forest departments is to ensure that all staff members are well-trained and informed in the more technical areas of conserving, managing and using forest genetic resources. Moreover, progress towards greater participation in forestry and conservation will require knowledge of participatory approaches and means of implementing them.

It is crucial that staff members who deal with local communities are trained in these matters. Another challenge is to avoid bureaucratic bottlenecks that hinder problem solution and communication not only between officials and local communities, but also between different levels within bureaucracies.

## 2.5 JOINT PROTECTED AREA MANAGEMENT

A protected area is an area which has been declared legally protected by the government under the Wild Life (Protection) Act of 1972 (WLPA). An area is declared as "protected" because of its high ecological or biodiversity value, or because of its diversity or rarity of wild plants, animals and ecosystems.

These areas perform important ecological functions such as maintaining the micro-climate and protecting water catchments. A PA is therefore given special protection so that the natural environment is able to thrive without destructive human interference or exploitation.

As of early 2000, there are 554 PAs in India with a total area of 1,54.037.38 sq. km (including marine PAs), making up 4.69% of the total land area.

There are three kinds of PAs created by the WLPA: sanctuaries, national parks and closed areas.

- In national parks practically no human activity relating to resource-use is allowed.

For instance, in a national park it is prohibited for livestock to enter or graze in the area. Exceptions to total prohibition of resource-use activities are those activities which may be necessary for the protection of wildlife. Thus, for example, grass cutting by villagers is allowed inside Keoladeo Ghana National Park, Bharatpur, in order to maintain the area's wetland environment.

- In sanctuaries only regulated resource-use is allowed. For example, livestock grazing is allowed under certain regulations.
- The third category, known as 'closed area', is virtually redundant now and has rarely been used.

PAs may include areas known as reserve forests and protected forests (both set up under the Forest Act of 1927), revenue land or private (mainly agricultural and plantation) land.

**Box 4**

**THE ECOLOGICAL ROLE OF WILDLIFE IN MAINTAINING ECOSYSTEMS**

Why is it so important to conserve wildlife? The skeptic might say that it is only a concern of the elite, i.e. those who can afford the luxury of feeling affectionate towards a few 'cuddly' animals. However, the inherent right of species to survive is a deep-rooted ethical concern in India, not just an elitist preoccupation. As importantly, wildlife plays a crucial ecological role in maintaining the health of ecosystems, resulting in tangible benefits to local communities such as fisher folk, marginal farmers and forest tribals. How do the conservation of wildlife and their natural habitats help local populations and the country as a whole?

- Animals, plants and micro-organisms sustain and regenerate the quality of water, air and soil. Healthy forests, lakes, rivers, grasslands, coasts, seas and agricultural lands provide water to drink, fertile soil to grow food, and raw materials for food, medicine, clothing, housing and energy. Rural community livelihoods depend on biologically diverse ecosystems.
- Wild animals and plants make up a substantial part of the diet of rural communities - as much as 50% of the diets of many forest and coastal people. During famine when crops fail wild animals and plants are a crucial source of food.
- 75% of the world's population, according to the World Health Organisation, is directly dependent on animals and plants (mostly wild) for its medicinal needs. Hundreds of critical medicinal products used world-wide, which have saved millions of lives, have come from wild species.
- Agriculture depends on wild plant relatives of crops for the continuation of traditional crop varieties. Cross-breeding with wild varieties develops crops and livestock with desired qualities,

such as resistance to diseases.

Ecosystems are based on the maintenance of a fine balance. Pull out one thread from the web of life and the entire tapestry starts unravelling. For example, what happens if a tiger is exterminated from an ecosystem? The prey-predator relationship between tigers and deer ensures that deer numbers do not exceed the carrying capacity of the ecosystem. By removing tigers, deer numbers could increase rapidly. This could lead to overgrazing of the landscape, affecting the survival of hundreds of other animals and insects who depend on the depleting stock of plants. Without sufficient food, deer numbers start falling... and so on. Ultimately the soil, water and vegetation that support human life are destroyed.

The management of PAs is done by the Wildlife Wing of the Forest Department. The main law applied is the WLPA, which gives PAs legal protection against hunting and capture of its wildlife, and exploitation of its natural resources. To a significant extent the WLPA has been successful in halting the decline of wildlife and the destruction of the natural environment. Related laws like the Forest (Conservation) Act of 1980 have also contributed towards saving and conserving natural habitats.

While the Forest Department has been quite successful in conserving PAs, it is not an uncomplicated success story. Many of the good intentions of the WLPA have backfired, and are threatening its own effectiveness. One of the main problems is that the WLPA depends on a centralised, top-down approach that has not been sensitive to the issue of local communities living in and around PAs.

About 3 million people live inside PAs, and several million more live around them. These people depend on the resources and the ecosystems of the PA for their livelihoods and often have customary rights (i.e. rights obtained through customary or traditional usage) to such resources. They depend on natural resources for:

- Fodder
- Firewood
- Medicinal plants
- Traditional activities such as religious ceremonies in sacred groves
- Hunting and fishing for food, sport or for cultural reasons. They may also hunt as a form of self-defence against wild animals that attack livestock or humans and damage crops.

While the WLPA includes provisions for catering to some local needs, these have usually been disregarded in practice, and the attitude evident in official conservation programmes is that humans are an obstacle to conserving the environment. As mentioned above, in national parks there is a complete prohibition on all human activity, and in sanctuaries there are severe restrictions on resource extraction.

Often communities have been forcibly moved out of a protected area, e.g. in Kanha National Park (Madhya Pradesh), Ranthambore National Park (Rajasthan) and Corbett National Park (Uttar Pradesh). Such displacement has at times helped to create undisturbed core zones for wildlife. However, displacement and resource use restrictions, along with daily harassment by forest staff and reduced ability to defend themselves against wild animal damage, has also caused severe hostility and resentment amongst local communities.

These kinds of situations have led to much suffering among the local people, many conflicts between them and the PA authorities, and lack of support for conservation among local communities leading to activities like illegal trading of natural resources. This has made it very difficult for the PA authorities to function effectively to protect wildlife.

**Box 5**

**THE ROLE OF PAs IN PROTECTING COMMUNITY INTERESTS**

While the negative impacts of PAs on people are undeniable, there is a silver lining that is often ignored. The significant role of PAs in stopping or slowing the march of the rapacious industrial economy, has also aided in indirectly protecting vulnerable rural communities from being physically and culturally swamped. In many (though by no means all) areas the PA boundaries are the only thing that stands between adivasis and others being turned into industrial labour and city-dwellers servants, or their resources becoming raw material for factories. PAs have also helped to retain the ecological integrity of many areas, upon which the lives and livelihoods of local communities depend. This includes water, nutritional foods, medicinal plants, and other critical inputs into the lives of such people. It is interesting, for instance, that during the serious incidence of malnutrition deaths amongst adivasi children in

eastern Maharashtra, the adivasis inside the Melghat Tiger Reserve forests hardly suffered. Similarly, doctors testify that the health status of Soliga tribals inside the Biligiri Rangaswamy Temple Sanctuary is far better than their counterparts outside the forest.

The problem is, such benefits are often not realised or articulated, or are swamped by the more visible and often more serious ways in which local communities are denied legitimate access to resources, or are otherwise harassed. Removing such violations of basic rights, and creating greater awareness of the positive role of PAs, would help generate considerable more support for conservation.

The concept of JPAM is a radical shift away from the centralised, bureaucratic wildlife policies that have prevailed so far. In a nutshell, the key aims of JPAM are the conservation of PAs, along with ensuring that the livelihood needs of local communities are met in a sustainable manner. JPAM is a method of conserving the environment within an official Protected Area, whereby communities who live in the area share the responsibility for looking after it along with government officials.

This also means that the people gain benefits from the area, such as sharing in forest produce or fishing in the rivers for their own use, or managing and obtaining revenues from tourism. But since their own livelihoods depend on it, they make sure that they do not over-exploit it. In other words, it is in their own interests to use the grasslands, rivers, coasts and forests in a sustainable way – in a way that will keep the environment alive, diverse and healthy in the long term. As described below (Q.18), they are also likely to become fierce defenders of nature against destructive commercial forces. They should also see it in their interest to keep certain areas inviolate, free from all human use – much as they did for sacred groves.

Thus the key aspect of JPAM is the revival of a stake in conservation amongst local communities. A strong stake in the conservation of the environment is not likely to be created unless villagers have the security of land tenure and access to natural resources - not as a concession which may be snatched away at any time by the government, but as a legal, traditional right. (Security of tenure is not, of course, the only guarantee to

sustainable resource use. It must be complemented by local institutions and systems of resource management.)

Secondly, a change in attitudes is vital. This includes attitudes of local people who see conservation as a hindrance to their daily access to resources: attitudes of conservation agencies and forest officials who view locals as a hindrance to conservation: and attitudes of development professionals or business interests who see conservation as a hindrance to 'progress' and 'development'. Thus, forest officials, for example, need to acknowledge that the potential role of local communities extends far beyond providing bits of indigenous environmental knowledge which are often incorporated into official conservation efforts. And local communities and social activists need to recognise that wildlife has an intrinsic right to live, and that the Forest Department is not a monolith of corrupt officials.

The aims of JPAM would need to be achieved through legal and institutional mechanisms which promote a partnership between local communities and government officials.. NGOs and independent experts would also be involved.

## 2.6 SOCIAL FORESTRY

The National Commission on Agriculture, Government of India, first used the term 'social forestry' in 1976. It was then that India embarked upon a social forestry project with the aim of taking the pressure off the forests and making use of all unused and fallow land. Government forest areas that are close to human settlement and have been degraded over the years due to human activities needed to be afforested. Trees were to be planted in and around agricultural fields. Plantation of trees along railway lines and roadsides, and river and canal banks were carried out. They were planted in village common land, Government wasteland and Panchayat land.

Social forestry also aims at raising plantations by the common man so as to meet the growing demand for timber, fuel wood, fodder, etc, thereby reducing the pressure on the traditional forest area. This concept of village forests to meet the needs of the rural people is not new. It has existed through the centuries all over the country but it was now given a new character.

With the introduction of this scheme the government formally recognised the local communities' rights to forest resources, and is now encouraging rural participation in the management of natural resources. Through the social forestry scheme, the government has involved community participation, as part of a drive towards afforestation, and rehabilitating the degraded forest and common lands.

This need for a social forestry scheme was felt as India has a dominant rural population that still depends largely on fuelwood and other biomass for their cooking and heating. This demand for fuel wood will not come down but the area under forest will reduce further due to the growing population and increasing human activities. Yet The government managed the projects for five years then gave them over to the village panchayats (village council) to manage for themselves and generate products or revenue as they saw fit.

Social forestry scheme can be categorized into groups : farm forestry, community forestry, extension forestry and agro-forestry.

## Farm forestry

At present in almost all the countries where social forestry programmes have been taken up, both commercial and non commercial farm forestry is being promoted in one form or the other. Individual farmers are being encouraged to plant trees on their own farmland to meet the domestic needs of the family. In many areas this tradition of growing trees on the farmland already exists. Non-commercial farm forestry is the main thrust of most of the social forestry projects in the country today. It is not always necessary that the farmer grows trees for fuel wood, but very often they are interested in growing trees without any economic motive. They may want it to provide shade for the agricultural crops; as wind shelters; soil conservation or to use wasteland.

## Community forestry

Another scheme taken up under the social forestry programme is the raising of trees on community land and not on private land as in farm forestry. All these programmes aim to provide for the entire community and not for any individual. The government has the responsibility of providing seedlings, fertilizer but the community has to take responsibility of protecting the trees. Some communities manage the plantations sensibly and in a sustainable manner so that the village continues to benefit.

Some others took advantage and sold the timber for a short-term individual profit. Common land being everyone's land is very easy to exploit. Over the last 20 years, large-scale planting of Eucalyptus, as a fast growing exotic, has occurred in India, making it a part of the drive to reforest the subcontinent, and create an adequate supply of timber for rural communities under the augur of 'social forestry'.

## Extension forestry

Planting of trees on the sides of roads, canals and railways, along with planting on wastelands is known as 'extension' forestry, increasing the boundaries of forests. Under this project there has been creation of wood lots in the village common lands, government wastelands and panchayat lands.

Schemes for afforesting degraded government forests that are close to villages are being carried out all over the country.

## Agro- forestry

Planting of trees on and around agricultural boundaries, and on marginal, private lands, in combination with agricultural crops is known as agro-forestry.

Social forestry, schemes that have been started all over the country have made a considerable difference in overall forest cover in a short time.

Increasing population has been causing a serious problem of unemployment and poverty throughout the world. Agriculture is the major source of livelihood in rural areas. However, agricultural production is heavily dependent on rainfall, microclimate, surrounding forests, eco-system and ability of the farmers to make timely investments on critical inputs. Unfortunately, all these natural resources such as land and forests have been over-exploited, while the other resources like water and livestock have been neglected and misused in the past. As a result of denudation of our forest resources, there has been acceleration in soil erosion and floods. This has affected the ground water table and storage capacity of our reservoirs. As an effect of change in climate, farmers all over the country have been experiencing erratic and scanty rainfall more frequently than before. This has been suppressing agricultural production directly. Furthermore, small land holdings, overexploitation of land resources and inadequate capital have turned rainfed agriculture into a losing proposition. Gradually, most of these lands located in semi-arid tropics are turning into wastelands.

Presently, over 50% of the land resources are either underutilised or wasted due to low productivity and uncertainty of recovering the investments. Such lands are suitable for introducing treebased farming, as the trees are hardy and capable of surviving the vagaries of nature. Among the tree species, farmers have a wider choice for selection, but profitability should be the most important factor for cultivation. Over the last three decades, many schemes to promote tree planting were launched by the Government and private agencies. Among them, cultivation of fruits and timber species on private lands was most successful. This was because fruits and timber could be sold easily in the local market at a remunerative price and hence the profitability of such schemes was very high.

## Tree Species for Income Generation

According to a recent study, a majority of the farmers in Maharashtra State have opted for growing fruit trees on their wastelands. This was followed by timber and pole species.

Among 35 most popular tree species of the state, 18 species were grown for food, 8 for timber, 3 for fuelwood, 2 each for oil and ornamental purpose and 1 each for fodder and fibre. The most preferred among them were, eucalyptus (*Eucalyptus hybrid*), mango (*Mangifera indica*), teak (*Tectona grandis*), Custard apple (*Annona squamosa*) and jujubee (*Zizyphus mauritiana*). Well established fruits grown on commercial scale were not a part of the study. However, this preference is not only based on the profitability, but also on market demand for the produce and field publicity.

Eucalyptus is the most popular species, because of reasons other than high returns. First of all, eucalyptus has good demand as pole in local markets. Any wood that is not sold as pole is purchased by paper and pulp mills at the site. In addition to assured demand and an attractive price, eucalyptus is a fast growing non-browsing, coppicing species with a short harvesting cycle of 4-5 years and well adapted to adverse agro-climatic conditions. Being one of the very few species promoted by the wood based industries, it has received wider publicity. Other tree species which were cultivated in India on a commercial scale under farm forestry by farmers were *Casuarina equisetifolia* in coastal areas and Poplar (*Populus deltoides*), which is confined to small regions in Northern India, beyond latitude 28o N. It was also observed that the popularity of the species varied from region to region, depending on the demand for the produce,

marketing infrastructure, agro-climatic conditions and availability of inputs. In Nasik district of Maharashtra, eucalyptus was grown by a large number of farmers, because of the infrastructure established by the Eucalyptus Growers' Cooperative for the supply of technical know-how, inputs and marketing of produce. However, the small holders had shown preference for fruit species, while the medium and large holders preferred timber species. In spite of its popularity among the farmers, it was surprising to observe that eucalyptus was not the most profitable species promoted under social forestry in India.

The benefit cost analysis of 14 important fruit and timber species based on the data collected from the farmers is presented in Table 2. These species include *Eucalyptus, Leucaena leucocephala, Melia azedarach, Thespesia populnea, Dendrocalamus strictus,* Sesbania sesban, Annona squamosa, Zizyphus mauritiana, Tamarindus indica, Anacardium occidentale, Mangifera indica, Moringa oleifera, Azadirachta indica and Tectona grandis. It can be observed that pole timber such as Melia, leucaena, bamboo and portia start generating income from the third year. Sesbania sesban starts generating income during the first year itself and completes its economic life in 2-3 years, while eucalyptus needs 4-5 years for the first harvest. Sesbania sesban coppices well in the areas where moisture supply is adequate, but it are advantageous to sow the seeds again after the first harvest, because of high vigour of the seedlings. Melia, Subabul and Eucalyptus coppice well and thus the plantations can be maintained to harvest 3-4 crops. Portia trees are pollarded at an interval of three years and maintained for 20-25 years. Harvesting of bamboo starts in the third year and continues every year for about 20-25 years.

TABLE 2 ANALYSIS OF INCOME (IN INDIAN RUPEES) FROM DIFFERENT SPECIES

| Name of the Species | Common Name | Duration | No.trees/ Ha | Net/Tree/ Year | Net/ha/ year |
|---|---|---|---|---|---|
| *Sesbania sesban* | Sesbania | 2 | 5000 | 4.80 | 24000 |
| *Melia azedarach* | Chinaberry | 9. | 974 | 24350 | 2500 |
| *Leucaena leucocephala* | Subabul | 9 | 2500 | 13.88 | 34575 |
| *Eucalyptus Hybrid* | Eucalyptus | 9 | 2500 | 9.24 | 23100 |
| *Dendrocalamus strictus* | Bamboo | 10 | 625 | 23.33 | 14581 |
| *Thespesia populnea* | Portia / (Bhendi) | 10 | 625 | 83.93 | 52456 |
| *Tectona grandis* | Teak | 20 | 625 | 80.00 | 50000 |
| *Azadirachta indica* | Neem | 75 | 200 | 50.00 | 10000 * |
| *Moringa oleifera* | Drumstick | 10 | 400 | 124.00 | 49600 * |
| *Annona squamosa* | Custard apple | 10 | 400 | 29.69 | 11876 * |
| *Zizyphus mauritiana* | Jujubee | 10 | 400 | 48.52 | 19568 * |
| *Mangifera indica* | Mango | 50 | 100 | 100.00 | 10000 * |
| *Anacardium occidentale* | Cashew | 50 | 156 | 125.00 | 19500 * |
| *Tamarindus indica* | Tamarind | 50 | 45 | 463.00 | 20835 * |

* **Income from wood has not been taken into account.**

** **Prices of 1989-90 have been taken for calculation.**

Neem is an oil seed tree with pesticidal properties, which starts fruiting from the fourth year. However, good bearing starts after 7-8 years and continues for 75-100 years. A neem tree can yield 50-100 kg seeds every year. Drumstick starts fruiting from the second year and continues to provide income for 10-15 years. Fruit trees like Jujubee, custard apple, mango and cashew start fruiting from the third year while tamarind starts producing fruits after 7-8 years. All these species except neem, mango, cashew and tamarind, can be planted on field bunds without affecting arable crops, if the farmers do not have adequate land for establishing large plantations.

## Development of Orchards - Superior System

Establishment of fruit orchards is the most beneficial system, if the farmers have water resources to nurture the plants in the initial years. Land having a soil depth of 1-2 m, even with uneven topography can be used for establishing orchards with fruit species such as mango, cashew, tamarind, ber, custard apple, Indian gooseberry (Amla), etc, which can bear fruits without regular irrigation. These species can be easily grown in regions where the annual rainfall is more than 800 mm.

For ensuring success of this programme, the primary step should be to develop the land into small leveled plots. If the land is sloppy, then it should be converted into contour terraces of 5-10 m width. This helps in reventing soil erosion and retaining rain water in the field itself. It is also advisable to dig pits 10 x 10m apart. The surplus rain water can be stored in a farm pond dug at a lower elevation of the field, and used for providing protective irrigation to fruit trees. Supplementary water sources should be tapped, either through open or bore wells to irrigate the plants during summer, as the farm pond will not have water throughout the year.

The grafted fruit plants should be planted either in the centre or about 1m away from the field bund (in case of terraced plots). Then, the field bunds can be used to plant short duration tree species such as papaya, drumstick, pigeon pea, castor, mulberry, etc for supplementary cash income. Other tree species such as leucaena, gliricidia (for fodder and green manure), acacia, casuarina (for fuel), agave and a wide range of medicinal herbs can also be established on the bunds and borders. The interspace can be used to grow locally grown food crops, to ensure food supply for the families. The short term crops help the families to earn some supplementary income, till the fruit trees start bearing. As the farmers visit their fields regularly, it has been observed that the crop yields increase by 50-200%, in spite of 20% space being reduced due to the establishment of fruit plants.

Generally, the fruit trees start bearing fruits in 4-5 years, when the farmers can easily earn about Rs 20,000-25,000 on 0.4 ha land and lead a comfortable life. This is an ideal system as it ensures the supply of food, fodder, fuel, timber, medicinal herbs and cash income. With establishment of orchards, they can also maintain some livestock and further increase their income. Above all, these orchards establish a permanent green cover on the earth, which is necessary to protect our environment.

**Activity 2**

1. Discuss in detail various laws pertaining to forest management in India. What do you understand by term forest policy?
2. What is the rationale behind joint protected area management?
3. Give your views on social forestry in India.
4. Discuss the history of forest management right from the British era.

## 2.7 SUMMARY

Natural resources management is increasingly the subject of social and political power struggles between groups claiming an interest in specific resources. Today, it is not possible to conserve forest genetic resources unless technical expertise is combined with an understanding and consideration of the underlying political and cultural processes. We later in the unit it has been explained that successful conservation of forest genetic resources requires the participation of local people, and that governments play a key role in this process by providing-or not providing-a supportive legal and institutional environment. Many studies show that the optimal formula for successful forest conservation is joint control and management by government and local people. Finally approach of social forestry was discussed as forestry for the people and by the people. In social forestry the people are the direct and not the indirect beneficiaries as in the case of traditional forestry. Social Forestry cannot develop without full participation of the people.

## 2.8 FURTHER READINGS


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POST GRADUATE PROGRAMME
M.A. (PREVIOUS) ECONOMICS

# Paper - IV (A)
# M.A. (PREVIOUS) ECONOMICS

## DISTANCE EDUCATION
## SELF INSTRUCTIONAL MATERIAL

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| | |
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PAPER - IV (A) M.A. (PREVIOUS) ECONOMICS

# BLOCK - IV

# BLOCK 4 ECONOMICS OF SOCIAL SECTOR AND ENVIRONMENT

This block comprises two units. The first unit deals with education and related aspects. It basically throws light on human and physical capital; demand for education and social vs. private demand; Cost of education; Expenditure on education; Social and private costs of education; Wastages and stagnations in current education system; Benefits of education; educational planning and economic growth; Cost benefit analysis and education; and educational financing

The second unit gives you the understanding and the need of health care and its planning in developed and developing nations. It discusses determinants of health and related approaches of demand and supply of health care. Unit also explains health care financing and human life value in detail. 'Production of health care' along with theories and studies has been discussed and health care disparities are being described along with institutional issues involved in health care delivery.

# UNIT 1
# INTRODUCTION TO ECONOMICS OF EDUCATION

**Objectives**

**On successful completion of this unit, you should be able to:**

- Appreciate the concepts of human and physical capital
- Identify the demand for education in societies worldwide
- Analyse cost of education along with various costs involved
- Determine the expenditure incurred on education along with social and private costs and wastages and stagnations.
- List the various benefits of education
- Understand the concept of educational planning and its relationship to economic growth.
- Recognize the approach of Cost Benefit Analysis.
- Know the steps taken by government and non government bodies for educational financing

**Structure**

1.1 Introduction

1.2 Human and Physical capital

1.3 Demand for education – social vs. private demand

1.4 Cost of education

1.5 Expenditure on education

1.6 Social and private costs of education

1.7 Wastages and stagnations

1.8 Benefits of education

1.9 Educational planning and economic growth

1.10 Cost benefit analysis and education

1.11 Educational financing

1.12 Summary

1.13 Further readings

## 1.1 INTRODUCTION

If more education leads to faster economic growth, then investments in education could pay for themselves in the long run, and could also play a role in reducing poverty. Such reasoning could be crucial in bolstering political support for education investments and ensuring their sustainability. This page considers the evidence for an education-growth link, and explores some of the issues that governments and donors face in making investments which will best take advantage of the potential for education to contribute to economic development.

There are two very basic reasons for expecting to find some link between education and economic growth. First of all at the most general level it is intuitively plausible that living standards have risen so much over the last millennium and in particular since 1800 because of education. Progress of the sort enjoyed in Europe was not observed in the illiterate societies that have gradually merged into the world economy over the last two hundred years. To the most casual observer it must seem that there is a link between scientific advance and the way in which education has facilitated the development of knowledge. Of course the Curies and the Newtons of this world are few and far between. But people with only very limited education often find it difficult to function at all in advanced societies. Education is needed for people to benefit from scientific advance as well as to contribute to it.

Secondly, at a more specific level, a wide range of econometric studies indicates that the incomes individuals can command depend on their level of education. If people with education earn more than those without, shouldn't the same be true of countries? If not the rate of change of output per hour worked, at least the level of output per hour worked in a country ought to depend on the educational attainment of the population. If spending on education delivers returns of some sort, in much the same way as spending on fixed capital, then it is sensible to talk of investing in human capital, as the counterpart to investing in fixed capital. The process of education can be analysed as an investment decision.

## 1.2 HUMAN AND PHYSICAL CAPITAL

We begin by a consideration of the links by which investment may affect the growth of output. Both physical and human capital directly impact on the productive capacity of an economy. However such direct effects may not be the most important.

More human capital may itself affect the rate of growth of physical capital. If human and physical capital is complements then increasing human capital raises the rate of return on physical capital.

Human capital refers to the stock of skills and knowledge embodied in the ability to perform labor so as to produce economic value. It is the skills and knowledge gained by a worker through education and experience.[1] Many early economic theories refer to it simply as workforce, one of three factors of production, and consider it to be a fungible resource -- homogeneous and easily interchangeable. Other conceptions of labor dispense with these assumptions. Therefore, human capital (as defined by Smith) and the productive power of labor are both dependent on the division of labor – *The greatest improvement in the productive powers of labour, and the greater part of the skill, dexterity, and judgment with which it is any where directed, or applied, seem to have been the effects of the division of labour.* There is a complex relationship between the division of labor and human capital.

In general physical capital refers to any non-human asset made by humans and then used in production. Often, it refers to economic capital in some ambiguous combination of infrastructural capital and natural capital. As these are combined in process-specific and firm-specific ways that neoclassical macroeconomics does not differentiate at its level of analysis, it is common to refer only to physical vs. human capital and seek so-called "balanced growth" that develops both in tandem.

Such analyses, however, fails to make distinctions considered critical by many modern economists. Natural capital grows, while infrastructural capital must be built. Even "balanced" economic growth includes many processes thought to be, or lead to, uneconomic growth. Human capital requires rest and must make choices whether to seek rest or income, which physical capital does not make: this is the rest problem.

The underlying rate of technical progress in an economy, by which is meant the increase in output due to factors other than measured inputs, may depend on how much educated labour there is in the economy. Rates of return on investment must consider both the direct and indirect effects of such investment. In assessing the effects of human capital on output we have both macro and micro evidence. To place the problem in context it is useful to set out how the stock of both human and physical capital in Africa

compares with non-African countries. The growth rate for the average of primary and secondary school completion in Africa is half that for South Asia, as is the growth rate of income. The growth rate for human capital is a weighted average of the growth rates for primary and secondary school completion rates with the weights taken from 1980. While the averaged growth of education in Africa is lower than both East Asia and South-East Asia the gap is small relative to the differences in the growth rate of physical capital. It is at the secondary level where Africa's growth rate is far below that of any other developing region. At this level the gap between Africa and other developing regions has widened substantially. There is evidence that it is education at the secondary level which is important for increasing productivity in manufacturing. This poor performance may have serious implications for Africa's ability to compete in a global market place.

The gap between Africa and the rest of the developing world also widened in the case of the physical capital stock.. While this is an extreme figure it dramatizes the point that there is a widening gap between Africa and other developing regions for physical capital and some dimensions of human capital. There is research suggesting that the level of education as well as its growth rate may be important: "Given the initial level of per capita GDP, the growth rate is substantially positively related to the starting amount of human capital. Thus poor countries tend to catch up with rich countries if the poor countries have high human capital per person (in relation to their level of per capita GDP), but not otherwise. As a related matter, countries with high human capital have low fertility rates and high ratios of physical investment to GDP." (Barro, 1991, p.437). If this view is correct then it is the high levels of secondary and primary school completion in 1965, rather than the changes since then, which are important for explaining the differences across the countries.

Why might the level of education be important? One effect of low levels of the human capital may be to lower the ability of the economy to absorb information. Indeed one of the great virtues of education, which has been shown in many micro studies, is that it makes workers more flexible. It may be the case that levels matter as well as changes in those levels. Even by 1990 the stock of human capital in Africa was far below its level in East Asia in 1965. However, in 1965 Africa was marginally ahead of South Asia. While this region has not experienced the dramatic growth of East Asia, it has outperformed

Africa. It is clear from the above that while human capital may have an important role to play this role will be vitiated unless policies ensure rapid investment in other forms of capital. The problems associated with this were covered in the African Development Report for last year.

## 1.3 DEMANDS FOR EDUCATION – SOCIAL VS PRIVATE DEMAND

The notion of "demand" in schooling is now in common currency in the educational policy world. Many identify a critical shift of debate and reform from traditional models of the past to dynamic ones of the future to be defined by the change from "supply-dominated systems" towards more demand-sensitive arrangements. This characterization of shifts from the schooling of yesterday to that of tomorrow makes this a subject ripe for exploration as part of the OECD/CERI "Schooling for Tomorrow" programme. But what does "demand-driven" mean in practice? Is it more than a facile slogan? As this section shows, a family of terms and developments related to demand – choice, personalization and individualization – are some of the most important, as well as controversial, aspects of education today. It may be perceived as the private demand for education. There is need to clarify these different concepts and their relationships. This publication complements another recently published in the "Schooling for Tomorrow" series on "personalizing education" (2006a), as part of OECD/CERI's contribution to clarifying issues in the way ahead for schooling.

Demand is a multi-dimensional concept which warrants further exploration. Once these dimensions start to come into focus, they should be subject to empirical analysis in order to move beyond abstraction and ideology. Demand has quickly become an established part of the discourse on educational reform across the world. It is a controversial concept. For some it is associated with the precepts of New Public Management – an increased role for clients and markets, even privatization – which are at odds with the social and humanistic traditions of education to promote equity, cultivate humanity, and sustain local communities. It may be perceived as the social parlance of demand for education. All these senses have a reflection in the broad concept of "demand", whether to seek to improve public services via the pressures of quasi-markets

or to enhance participation and active forms of personalized teaching and learning. That enhancing the role of demand takes a prominent position in the reform debates in many OECD countries, while being such a broad elastic concepts, calls a systematic clarification of both the concept and associated empirical evidence.

The point of departure has been clarification in terms of the ways in which demand can be expressed (exit and voice) and the potential impacts a more demand-led system may have for key issues like quality and equity. Thus demand is understood as a multi-dimensional concept that needs to be unpacked. The dimensions of exit and voice at both the collective and individual levels have been outlined in this chapter. These different levels and expressions of demand interact in complex ways. For example, the demands for special types of education from specific societal groups (collective voice) lead to diversity that allows individuals to choose. Better understanding the mechanisms for expressing demand and their interactions is not only useful in itself but it also permits a focus on the outcomes resulting from applying these mechanisms at the levels of schools and the school system. Again the relations are complex. Greater voice may be a force pushing schools to deliver relevant and high-quality teaching; it could be a way for privileged parents – with greater influence and a more developed idea of their demands – to dominate school decision-making in favour of their own children.

Worldwide, enrolment in higher education has jumped by 50 per cent since 1999. Some 144 million students were enrolled in tertiary education in 2006, 51 million more than in 1999. It is now commonplace to say that participation rates of 40 to 50 percent in higher education are considered vital to economic growth.

Clearly not all countries and within countries, not all social groups, are benefiting from the massification of higher education. UNESCO's regional Higher Education conferences have asked how higher education can become more accessible to cultural and linguistic minorities, indigenous groups, the disabled or people living in remote areas. Migration trends, combined with increasing student mobility – expected to triple by 2025 – will further accentuate the diversity of student populations, calling for policies that promote access to learning and academic programmes and staff that respect cultural and linguistic diversity. Several countries have established quota systems, scholarships and special secondary schools to help students from disadvantaged groups prepare for

admission to universities. Addressing demand with a concern for equity and inclusion is a considerable challenge.

Across the spectrum of publicly provided goods and services, a new policy trend is emerging. Governments throughout the OECD coterie are realizing the importance of providing services that are better suited to the needs and demands of their citizens. From healthcare to pensions, governments are providing citizens with more choices, and improved channels for voicing their demands and shaping new initiatives and solutions.

Education is no exception to this trend. Within the sphere of schooling in particular as well as education more broadly, policy makers are seeking to encourage improved institutional sensitivity to the demands of parents and pupils. Consequently, the twin agenda of demand-sensitivity and personalization is growing in importance.

In the context of education, demand-sensitivity can be roughly understood as improving the responsiveness of the supplier of education (schools, educational policy makers) to the requirements and preferences of its consumers (parents and pupils). The terminology and fundamental idea are drawn from economics, although this is not meant to imply that education and the schooling system should be left to market forces - far from it. Rather, the idea is that public services, including education, should be purposely directed in such a way that they better fit the needs of those they are intended to benefit. Demand-sensitivity requires that schools should be reorganized so as to better fit the needs of learners. Thus, while market forces might conceivably push towards a 'one size fits all' educational 'product', demand-sensitivity necessitates an increased focus on each learner and thus a more personalized educational experience.

Debates surround the transforming educational system, which is in many OECD countries changing from the traditional "supply-dominated system" to more of a "demand-sensitive" system. However, since many in the education sector associate words like "demand" only with the economic market and dislike the application of such concepts to the educational system, these and similar terms are controversial.

So why use such terms? Educational debates employ these terms because words like "demand" are "as much about rights, wishes, and participation" as they are about financial gain. Demand can measure the level of satisfaction of a collective group or

individual, in visualizing to what extent expectations differ from reality. Table 1 shows how the dimensions and mechanisms of demand interact.

**Table 1: Dimensions and expressions of demand**

| | CHOICE | VOICE |
|---|---|---|
| INDIVIDUAL | Individuals choosing and changing a school or programme or leaving altogether like in home schooling. | Parents or students directly participating in schools' decision-making and having an important part in the learning process (personalisation). |
| COLLECTIVE | Groups starting schools—whether private or publicly-funded private—based on religious, ethnic, linguistic, or pedagogic goals. | Interest group influence on schooling issues, such as through curriculum consultation, lobbying, or pressure group politics. |

**For example,** students use choice (also known as exit) and voice—the two methods available— to express their demands. Students voice their displeasure in class or exit the school system altogether. Thus, not meeting demands can lead to problems such as in-class distractions, high truancy rates, and transfers to other schools. When families leave a school system, it loses individuals which could have made a difference in the school environment. On the other hand, the school to which the students transfer can further improve due to these families' involvement; thus, the differing levels of participation in the schools can increase the inequality between the schools.

## 1.4 COST OF EDUCATION

India has developed one of the largest systems of Higher Education in the world with over 230 universities and 6500 vocational colleges catering to about 10 million students. Most of these are publicly funded although some may be privately run. The financing of higher education, however, is often reprioritized due to competing demands

for budgetary funds from primary and secondary education sectors. As a proportion of GNP, Higher Education was only about 0.19 per cent in 1950-51. By 1980-81 it went up five fold to 1 per cent but by mid-1990s it dropped to 0.4 per cent. In the government plan outlay the share of higher education doubled for 9 per cent in the first five year plan to 18 per cent in the second. It increased to 25 per cent in the fourth but has now come down to 15 per cent in the seventh five year plan. In the eight five year plan it was around 8 per cent. It may be stated that the non-plan expenditure in education is huge compared to plan expenditure.

On the source of funding, the share of government expenditure (both state and central) increased from 49 per cent in 1950-51 to 76per cent in 1986-87. The share of non-government sector, which in India is largely student fees, declined from 33per cent in 1960s to less then half of what it was in 1950s. The share of 'other sources' that is, voluntary donation, endowments etc also declined. The issue of raising fees in government aided colleges and vocational institutions remained enmeshed in politics. As a result, this source which could potentially provide approximately 20per cent of the funds is currently funding barely 3per cent of the cost of education.

Resource crunch in higher education is being felt in a serious way. Other sources of financing besides the government have to be developed so that the massive expenditure required expanding, improving and bringing it to world standards could be carried out. With an expanding middle class and globalization this is possible provided innovative policies are formulated and implemented.

## Classification of Costs of Education

**Costs can be classified into two types:**

(a) Individual or private costs

(b) Institutional or public or social costs

**(a) Individual Costs or Private Cost**

Individual costs or private costs of education are those costs of education incurred by a learner or by his/her parents/guardians or by the family as a whole. Individual costs are of two types: direct and indirect.

***Direct costs***: These are those costs that are directly visible. They include all money expenditure incurred on different items by the student. For example, expenditure

on tuition fees, other fees and charges, purchase of books, stationary, uniforms, hostel expenses and transport.

***Indirect costs (opportunity costs):*** Indirect costs are those costs which are not directly visible. These costs are sometimes called 'opportunity costs or foregone earnings'. Opportunity costs refer to the value of students' time or earning forgone to continue the study.

**Institutional Costs of Education or Public Costs of Education**

Costs incurred at the institutional level (government, private or mixed) are called institutional costs or public costs of education. Public costs are those that include financing by the government on the basis of taxes, loans and other public revenues. The institutional costs of education are, generally, analysed using the following variables.

- Variable and fixed costs of education.
- Recurring and non-recurring costs of education.
- Current and capital costs of education.

We shall discuss these costs while discussing various costs types.

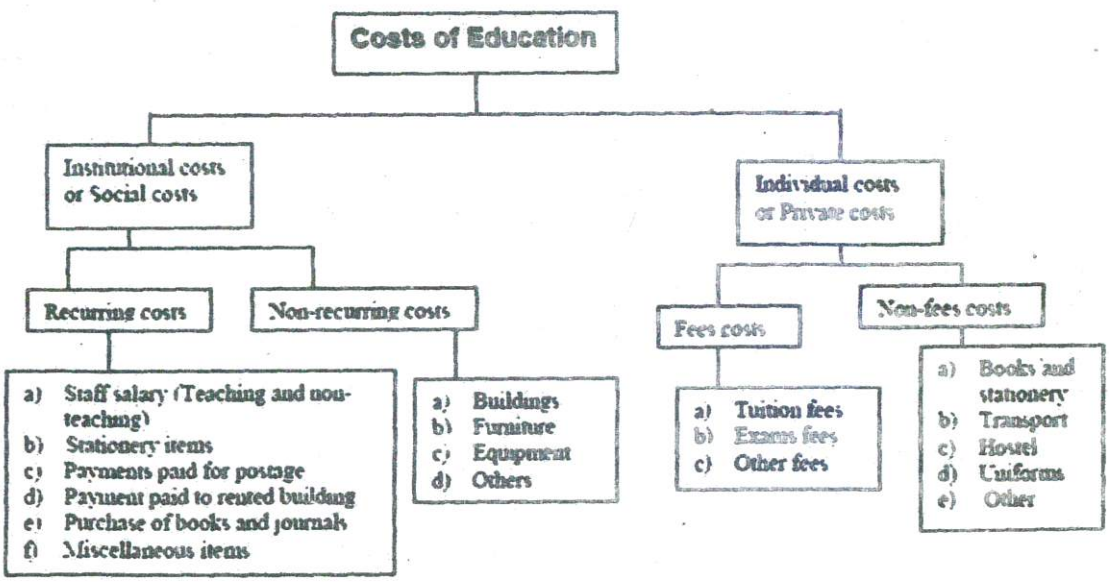


**Figure 1 Classification of costs**

## Types of Costs of education

The real nature of cost could be understood only when we understand the different concepts related to the 'costs' of education. As mentioned earlier, cost is the

actual expenditure of money incurred on, or attributable to, a specific thing or activity. For instance: on a query from learner as to how much cost would be for his/her graduation, the institution specifies the cost to be about Rs. 20,000/- per annum (about US $ 450), this is called a notional cost. But his/her cost was Rs. 30,000 (US $ 675) when he/she completed his/her graduation; this is called the actual cost (which depends upon all kinds of prices incurred during his graduation including private costs).

***Total Cost***

The 'total cost' is the sum of all fixed costs and all variable costs.

$$TC=TFC + TVC$$

Where,

TC = total costs,

TFC= total fixed costs and

TVC= total variable costs

Let's describe the two types of costs further.

***Total Fixed costs and Total Variable Costs:*** Fixed costs are defined as those that do not change with a change in the number of learners, e.g., costs on institution's building. In other words, the costs that do not increase or decrease with the changes in the level of activity of the institution are known as the fixed costs .Variable costs vary with every change in number of learners. e.g., costs on teachers, laboratory materials, stationary items. Therefore, total cost is an increasing function of enrolments i.e. enrolments increase, total cost increase. However, one cannot argue that certain costs are fixed, and others are variable for all time to time. For example, what will happen if the number of learners increases to a great extent? In this situation, not only the number of teachers has to be increased, but an additional number of classrooms may also have to be constructed. If the number of learners increases by a small amount, the variable costs on teachers may not change, in which case this may be called fixed cost.

## 1.5 EXPENDITURE ON EDUCATION

- Elementary education, to a large extent, is financed by the central government, the state governments and the local bodies. The contribution of the private sources has declined over the years.

**Plan and Non-plan Expenditure:**

The educational budgets of the central government as well as the state governments are classified into Plan (broadly development) and Non-Plan (broadly maintenance) outlays. The Plan expenditure on different sectors of education is presented in Table 50. The share of elementary education declined from a peak of 56 per cent in the First Plan to 30 per cent during Fourth Plan period, There has been gradual increase in the allocation for elementary education in the subsequent Plans. Eighth Plan outlay shows a substantial step-up in allocation to primary education as compared to Seventh Plan.

**Centre-State Partnership:**

Major share of expenditure on education is incurred by the central and state departments of education. In addition, many other departments also undertake education and training activities. The total expenditure on education has increased from Rs.7,085 million in 1968-69 to Rs. 251,562 million in 1992-93. The states accounted for 88.6 per cent of total revenue expenditure on education in 1991-92.

**Per Capita Budget Expenditure:**

The educational effort of different states is captured by per capita budget expenditure and the share of education budgeted (Revenue) to total budget of the state. The per capita budgeted expenditure on education increased by nearly four times (at current prices) during the same period

**Education in Centre/State Budgets:**

On an average, the states are spending 20 per cent of their budget on education as compared to 2.2 per cent for the central government. These shares have remained constant for the last few years.

**1.5.1 Expenditure on Education in India**

1. The importance of education in economic development is accepted across the ideological divide in economic theory and policymaking. However, what remains common to the recent phase of market-oriented reforms in India and the earlier phase of state-led development planning is the failure to ensure access to basic education for the masses. The limited spread of literacy and elementary education till date along with a miniscule proportion of the population having access to higher education provides a pathetic spectacle, especially in the backdrop of tall

claims regarding high rates of economic growth and technological advances achieved during the phase of economic liberalization. The post-liberalization period has actually witnessed a gradual withdrawal of the state from the sphere of education, adversely affecting both the spread as well as the quality of education in the country. The advent of the BJP-led government at the Centre in 1998 further witnessed the consolidation of two regressive trends in Indian education: motivated attempts to subvert its secular and democratic character; and reckless commercialization. particularly of higher education.

2. Following the defeat of the BJP-led government in the recently concluded Lok Sabha elections, a great deal of enthusiasm to reverse the process of communalization of education seems to have been generated within the policy circles. It needs to be understood, however, that the drive towards such 'detoxification' would remain half-hearted at best, if larger questions regarding the role of the state in education remain unattended. For instance, even if the communally tampered textbooks of the NCERT are replaced by secular ones, the number of schools which would adhere to such curriculum is too scarce to be able to out compete, let alone totally replace, the enormous apparatus of school education put in place by the RSS and its affiliates. Similarly, no matter how honestly the purging of RSS hacks from the state-run institutions of higher learning is carried out, the passage of the Private Universities Bill or even the continuance of the current dubious practice of granting deemed university status to all and sundry by the UGC, would pave the way for their eventual rehabilitation. A genuine effort to reverse the process of communalization of education would therefore imply reinventing the vital role of the state in this sphere. That of course cannot be achieved without making a departure from the marketization/commoditization paradigm, the scope for which has been provided by the commitment to spend 6% of GDP on education made in the Common Minimum Programme of the UPA government.

3. **Table** 2 below shows the combined expenditure of the Central and State governments on education as a percentage of GDP in the recent years. It can be easily observed that the total state expenditure on education in the country has

hovered around 3% of GDP, far below the 6% of GDP benchmark set by the Kothari Commission way back in 1968.

| Year | Central and State Governments' Combined Expenditure on Education as a percentage of GDP |
|---|---|
| 1999-00 | 3.3 |
| 2000-01 | 3.1 |
| 2001-02* | 3.1 |
| 2002-03** | 3.1 |
| Source: Economic Survey, 2002-03. | |
| Notes: * Revised Estimate, ** Budget Estimate. | |

The inadequacy of resources has stemmed primarily from the unwillingness of the Central government to undertake adequate expenditure on education. Table 3 amply demonstrates the negligible proportion of resources spent for education through Central Budgets in recent years, with the percentage of expenditure on education never exceeding 2.5% of total budgetary expenditure.

| Year | Expenditure on Education as percentage of Total Central Budgetary Expenditure |
|---|---|
| 1999-00* | 2.41 |
| 2000-01* | 2.49 |
| 2001-02* | 2.21 |
| 2002-03** | 2.39 |
| Source: Calculated from Expenditure Budget and Demand for Grants, various years. | |
| Notes: * Revised Estimate; ** Budget Estimate | |

The larger burden of expenditure on education is already being borne by the State governments, which are almost without exception caught up in a fiscal mess, thanks to the squeeze on transfer payments to the States and higher interest rates charged on their borrowings. It follows therefore that the promise of spending 6% of GDP on education contained in the Common Minimum Programme can only be achieved through a stepping up of Central government expenditure on education.

4. Despite the fact that the proportion of Central Budget expenditure on education did not experience any increase during its tenure, the NDA government proclaimed to have 'prioritized' elementary education by allocating a greater proportion of resources towards it. This so-called 'prioritization' can be seen from Table 4 where there is increase in the proportion of total budgetary allocation on education spent on elementary education (from 39% in 1999-00 to 43.96% in 2002-03) with a concomitant fall in the proportion of expenditure on university and higher education (from 29.58% in 1999-00 to 17.34% in 2002-03).

| Year | Expenditure on Elementary Education as percentage of Total Budgetary Expenditure on Education | Expenditure on University and Higher Education as percentage of Total Budgetary Expenditure on Education |
|---|---|---|
| 1999-00* | 39.00 | 29.58 |
| 2000-01* | 37.74 | 31.02 |
| 2001-02* | 44.32 | 20.45 |
| 2002-03** | 43.96 | 17.34 |
| Source: Calculated from Expenditure Budget and Demand for Grants, various years. | | |
| Notes: * Revised Estimate; ** Budget Estimate | | |

However, this counterpoising of elementary and higher education, in the name of 'prioritizing' the former, is nothing but an apology for not undertaking adequate expenditure in either of the two levels. This becomes evident from Table 5 that shows only a marginal increase in the expenditure on elementary education as a proportion of total budgetary expenditure in the recent years (0.94% in 1999-00 to 1.05% in 2002-03), which calls the bluff as far as 'prioritization' of elementary education is concerned, while there is a significant fall in the expenditure on university and higher education as a proportion of total budgetary expenditure (0.71% in 1999-00 to 0.41% in 2002-03).

| Year | Expenditure on Elementary Education as percentage of Total Budgetary Expenditure | Expenditure on University and Higher Education as percentage of Total Budgetary Expenditure |
|---|---|---|
| 1999-00* | 0.94 | 0.71 |
| 2000-01* | 0.94 | 0.77 |
| 2001-02* | 0.98 | 0.45 |
| 2002-03** | 1.05 | 0.41 |
| Source: Calculated from Expenditure Budget and Demand for Grants, various years. | | |
| Notes: * Revised Estimate; ** Budget Estimate | | |

Such diversionary tactics need to be strictly avoided. The Union government should accept the fact that Central Budgetary allocation on education is abysmally low for all levels and expenditure needs to be stepped up for elementary as well as higher education.

5. Free and compulsory education was made a Fundamental Right for all children in the age-group of 6-14 years through the 86th Amendment of the Constitution enacted in December 2002. The law suffers from the lacuna that the children below six years of age have been excluded from its purview. Moreover, the constitutional obligation towards free and compulsory education has been shifted from the State to the parents/guardians by making it their Fundamental Duty under Article 51A (k) to 'provide opportunities for education' to their children in the 6-14 age group. While setting these anomalies right remains to be an important objective, what should be of immediate concern is the financial commitment that this legislation entails. The Tapas Majumdar Committee appointed by the government had suggested a required expenditure of around Rs. 1.37 lakh crores over a ten year time frame (1998-2007) to bring all the children in the 6-14 age groups under the purview of school education by 2008.

Contributing its bit to the 'India Shining' campaign on the eve of the elections, the Ministry of Human Resource Development had publicly claimed through media advertisements that 3 crores out-of-school children were already brought back to school after spending Rs. 16,000 crores under the Sarva Siksha Abhiyan. It amounted to achieving 60% of the target in universalizing elementary education (i.e. 3 crores out of the estimated 5 crores out-of-school children brought back to school) by spending only 0.11% of the total expenditure of Rs. 1,36,922 crores estimated by the Tapas Majumdar Committee. This was nothing but a perfidious claim being made by the NDA government in order to conceal its sheer lack of commitment towards universalizing elementary education.

6. The budget estimates for total expenditure on education in the interim budget placed by the NDA government this year was Rs. 11,062 crores, which amounted to around 2.41% of total budgetary expenditure. Out of this, the budget estimates for elementary education stood at Rs. 6004 crores. The Tapas Majumdar Committee on the other hand had suggested an expenditure of Rs. 17,000 crores in 2004-05 for meeting the requirements of universal school education alone. The gap between the requirement and what the government is willing to spend is so large as to make a mockery of the goal of universal school education.

It is here that the UPA government has to make a decisive break from its predecessor. And it would do well to remember that the mobilization of adequate resources for universal elementary education would necessarily involve taxation of the rich and privileged. A cess on corporate taxes, personal income tax and customs duties on luxury imports, to mobilize additional resources for the Sarva Siksha Abhiyan can be a good beginning as far as the first budget of the UPA government is concerned.

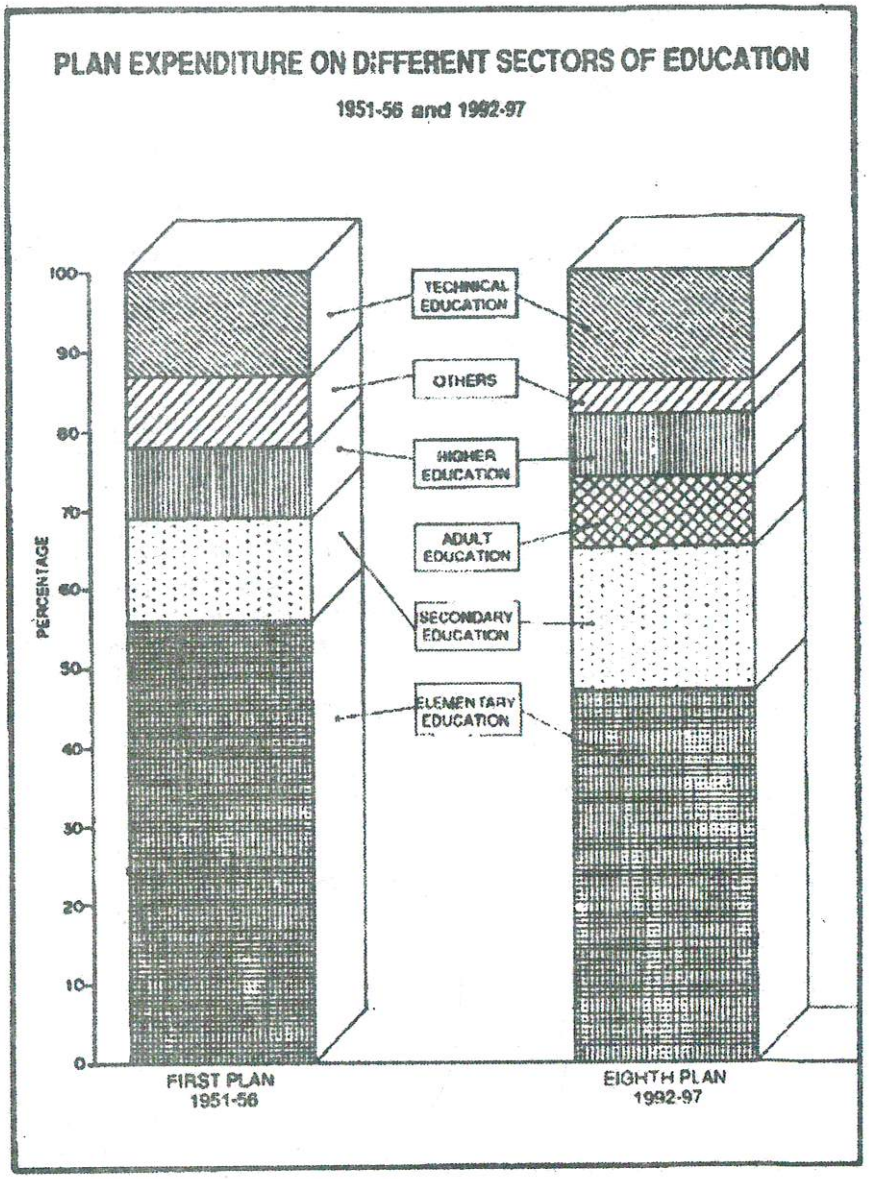


**Figure 2**

## 1.6 SOCIAL AND PRIVATE COSTS OF EDUCATION

The benefits and costs of educational investments are different for individuals and for society. In the private decision of whether or not to pursue a particular education program, (that is, the decision made by the individual or the individual's family), only the costs that the individual (or his or her family) bears and the benefits the individual (or family) receives are taken into account. For the social decision (that is, the calculation of whether a particular educational investment makes sense for society), all costs and all

benefits that accrue to anyone in the society are taken into account. From society's perspective, the opportunity cost is the *before-tax* foregone income, whereas from the individual's perspective (or that of the individual's family), it is the *after-tax* income foregone. Table 6 summarizes the direct and indirect, as well as the private and social costs of education. Notice that if education is provided by private schools that depend on student fees to cover all of their costs, then the direct private costs of education are equal to the direct social costs.

**Table 6**

| | Private Costs | Social Costs |
|---|---|---|
| Direct Costs | Out-of-pocket expenses borne by the student or the student's family, including:<br>• fees actually paid by the family;<br>• transportation costs incurred by the family;<br>• family's purchase of books, school uniforms etc. | All the resources directly used in the production of education,[3] including:<br>• time of teachers and other school employees (measured by salaries and benefits);<br>• cost of recurrent inputs, e.g., books, materials, heating and electricity, etc;<br>• other recurrent costs (sometimes borne by families), such as transportation, uniforms, meals, etc;<br>• cost of capital goods, e.g., buildings and equipment (measured by their rental value). |
| Indirect Costs (opportunity costs) | After-tax income foregone by the family, i.e., the value to the family of the best alternative use of the student's time, including:<br>• earnings foregone,<br>• value of production foregone in family business/farm. | Before-tax income foregone. (These are the same as private indirect costs except for taxes that would have been levied on the student's higher income; in other words, social indirect costs are higher than the private indirect costs by the amount of taxes foregone. See footnote 2.) |

If the government in a particular country covers all (or most) of the direct costs of university education (in the form of a grant, and not as a loan), then these subsidized costs will not be included in the family's calculation of whether or not to enroll a child in university.

## 1.7 WASTAGES AND STAGNATIONS

A suitably oriented system of education can facilitate and promote social change and contribute to economic growth by creating requisite attitudes for specific tasks of development. Expansion at all levels of education has accordingly been a major problem with planners and administrators. Although much has been done since independence to provide better educational facilities to large number of population on more uniform

patterns, a lot more remain to be done particularly in the field of elementary education. Facilities for universal elementary education are a prerequisite for equality of opportunity and the content and quality of elementary education determine the infrastructure of an entire educational system.

Wastage and stagnation have been major problems in the field of education, particularly in rural and semi-urban areas, among the economically and socially handicapped communities, and in the case of schools run by the government and other autonomous bodies like municipalities. It is true that some of the facilities - physical, material and human - created in this field go wasted for various reasons, including non-enrolment of the requisite number of pupils. This is despite the fact that adequate investments have not been made in our primary education edifice and facilities for study and work in many of the primary schools are just meagre. Things are a bit better in junior basic schools and in primary sections of high/higher secondary schools.

Stagnation - also known as retardation or grade repetition - implies retention of a student in a grade or a stage for more than the normal period of stay on account of unsatisfactory progress. Obviously, failures in school and public examinations which compel students to stay in a grade or a stage for an additional year lead to stagnation. In some cases they lead to wastage also, e.g. when a student is forced to leave the school if he/she can not pass a grade even in two consecutive attempts (years). Drop-outs, as pre-mature withdrawals are branded, belong to two distinct categories viz. those who are compelled by circumstances or exigencies at home or in the family and those who are forced out of schools, primarily because of unsuccessful/unsatisfactory performance and only occasionally because of misconduct. Socio-economic factors are mostly responsible for the first category and programmes such as mid-day meals were introduced to arrest the trend, though pressing demands to assist adults in the family during their work at home, on the fields and at other places (like shops run by the family) lead to drop-outs among children. A policy of no detention in a class or promoting every student to the next higher class or of disbanding end-of-class examinations or public examinations at the end of primary education has been tried out to reduce in size the second category of drop-outs.

Education as it is being practiced in the vast majority of our school today is so ill-planned and haphazard that we tend to depend more upon educational slogans and fads than upon actual educational philosophies and practices for an understanding of what 'good education' really means. Nevertheless, it should be quite a worthwhile exercise in the present confuse state of our educational development to seek clearly the path that we should follow. An acquaintance with the latest trends in education could also be worthwhile if only to realize how much leeway our schools have to make up in the education given to our children is to be really worth-while.

In Indian education, curriculum and text books are inadequate. The main criticism against the secondary schools is that allowance is not made for variation in aptitudes, interests and abilities. All the students are taught the same courses irrespective of their mental caliber and interests. All the students have to pass through the same straight jacket whether it fits them or not. This has resulted in maladjustments, mass failures and eventual stagnation in many cases. Eventually many students fail to pass in the examination because they have no choice. They are to take the burden of all the subjects. If he is expert in a subject and knows nothing in the other, he is treated as an unsuccessful candidate. He is also treated badly by his teachers. By this if, India wants to prove that it is giving equal status to every educational subject.

In addition, instruction imparted in our schools is book-centered and leaves a little scope for creative thinking and self expression. It is no wonder that a vast majority of students cannot write a few lines on any given topic. The reason for this mental vaccum are not far to seek. They only know about the facts that are important to exams, and they have to learn it by heart i.e. memorizes, but they know really nothing about the concept. They only memorize it due to its importance in the examination. In addition the teachers taught that materials in the class which are important in the examination. The students with some exceptions have been encouraged to cram answers to the spotted questions likely to figure in the examination papers and pass the examination. Unfortunately, the wagon of secondary education in this country has been hitched to a lamppost of passing the examination. It does not aim a lodestar of idealism, which should form the basis of all worthwhile education. The curriculum that is being given to us is now very outdated. It is introduced in 1986 under the National Policy of Education. At that time, it was good but

time has changed now. It needs many changes. In countries like China, students are taken in that path where they are interested to go or join. They are not forced to pass through the same tunnel of gate. Suppose if someone is interested in sports then right from the early ages they are trained and taught in that field only. Thus, later on they can become a well-known personality in that field. This system can be proved by watching the number of medals China gets in the Olympics. Likewise, in India also this system should be interested so that we can be developed as termed in economics.

Another malady be setting our secondary education is tremendous wastage and stagnation resulting from mass failures at the school leaving examinations conducted by various school boards in this country. Sometimes the pass percentage is below 50%; even in the school examination, the picture is no way better. This is not a healthy symptom and calls for a thorough probe and early remedy. No developing country can afford frittering away of scare resources in this way. It not only results in wastage of time, energy, and money, but also brings lots of frustration to the failed and his family. In this way the failure student losses his courage and sometimes a day comes when the failed leaves school. Like that, it is the wastage of human resources also.

In schools and colleges, there is the system of 'Ragging'. The school authorities should take proper action against the miscreants. It results badly to many students. Sometimes they have to leave the school also. Therefore, this system also ails our educational system.

Moreover, school is a place; a temple of 'LEARNING', but the alphabet 'L' now disappeared in real sense from this word, becoming the place of 'EARNING'. Why it is so? Why the teachers only come to earn and not to teach? Why they only like the students who are smart, handsome, and good in studies?

Lastly, school should be a place where the teaching should not be book centered. There should be practical and orals also. The examination system should be changed. It is to be more interesting and should be a place of enjoyment, learning and should be a place for doing and knowing the facts practically.

**Some Policy Issues**

To avoid apparent wastages through drop-out (particularly the forced cases) and stagnation a liberal policy of no-detention (if not of no-examination) can be advocated and has been accepted in some states.

It is apprehended that a no-detention policy will result in denial of admission to the post-primary level/class for some whom complete the primary stage, unless the educational infrastructure is proportionately expanded. Most schools will have their entry tests for the post-primary classes even in respect of students in their own primary sections. This will simply mean a postponed forced drop out at the end of class IV/V. And an argument that such a drop out is less harmful than drop out during the primary stage can hold water if and only if the primary education system is toned up. The other apprehended impact of such a policy will be a higher rate of failure with consequent increase in stagnation and drop out at the post-primary stage.

## 1.8 BENEFITS OF EDUCATION

Both individuals and countries benefit from education. For individuals, the potential benefits lay in general quality of life and in the economic returns of sustained, satisfying employment. For countries, the potential benefits lie in economic growth and the development of shared values that underpin social cohesion.

Much of the benefit of higher education accrues to individual students and their families. For members of all demographic groups, average earnings increase measurably with higher levels of education. Over their working lives, typical college graduates earn about 73 percent more than typical high school graduates, and those with advanced degrees earn two to three times as much as high school graduates. More educated people are less likely to be unemployed and less likely to live in poverty. These economic returns make financing a college education a good investment. Although incurring debt should always be approached with caution, even students who find it necessary to borrow a sizable share of the funds required to pay for college are likely to be financially better off relatively soon after graduation than they would be if they began their full-time work lives immediately after high school.

Society as a whole also enjoys a financial return on the investment in higher education. In addition to widespread productivity increases, the higher earnings of educated workers generate higher tax payments at the local, state, and federal levels, and consistent productive employment reduces dependence on public income-transfer programs. Because the individual outcomes affect others, it is not possible to neatly

separate the benefits to individuals from those shared by society as a whole. For example, all workers benefit from the increased productivity of their coworkers, and unemployment causes the most damage to those who are out of a job, but also results in a loss to the entire economy.

In addition to the economic return to individuals and to society as a whole, higher education improves quality of life in a variety of other ways, only some of which can be easily quantified. Moreover, the economic advantages already mentioned have broader implications. For example, in addition to increasing material standards of living, reduced poverty improves the overall well-being of the population, and the psychological implications of unemployment are significant. In addition, adults with higher levels of education are more likely to engage in organized volunteer work, to vote, and to donate blood; they are more likely to be in good health and less likely to smoke; and they are less likely to be incarcerated. The young children of adults with higher levels of education are read to more frequently than other children; they have higher cognitive skill levels and better concentration than other children. All of these areas affect social expenditures, in addition to general well-being. The indicators included here do not provide a comprehensive measure of the benefits of higher education. They do, however, provide an indication of the nature and extent of the return on our investment in educational opportunities.

Students who attend institutions of education obtain a wide range of personal, financial, and other lifelong benefits; likewise, taxpayers and society as a whole derive a multitude of direct and indirect benefits when citizens have access to postsecondary education. Accordingly, uneven rates of participation in higher education across different segments of U.S. society should be a matter of urgent interest not only to the individuals directly affected, but also as a matter of public policy at the federal, state, and local levels.

Benefits to individuals include:

- There is a correlation between higher levels of education and higher earnings for all racial/ethnic groups and for both men and women.
- The income gap between high school graduates and college graduates has increased significantly over time. The earnings benefit to the average college

graduate is high enough for graduates to recoup both the cost of full tuition and fees and earnings forgone during the college years in a relatively short period of time.

- Any college experience produces a measurable benefit when compared with no postsecondary education, but the benefits of completing a bachelor's degree or higher is significantly greater. As is the case for the individuals who participate, the benefits of higher education for society as a whole are both monetary and nonmonetary Societal benefits include:
- Higher levels of education correspond to lower levels of unemployment and poverty, so in addition to contributing more to tax revenues than others do, adults with higher levels of education are less likely to depend on social safety-net programs, generating decreased demand on public budgets.
- College graduates have lower smoking rates, more positive perceptions of personal health, and lower incarceration rates than individuals who have not graduated from college.
- Higher levels of education are correlated with higher levels of civic participation, including volunteer work, voting, and blood donation. Given the extent of higher education's benefits to society, gaps in access to college are matters of great significance to the country as a whole. This report shows that despite the progress we have made in improving educational opportunities, participation in higher education differs significantly by family income, parent education level, and other demographic characteristics.

**Observed patterns of postsecondary participation include:**

- Among students with top test scores, virtually all students in the top half of the family income distribution enroll in postsecondary education, but only about 80 percent of those in the lowest fifth of the income distribution continue their education after high school.
- Income differences tend to have a smaller impact on college enrollment rates of high school graduates with high test scores than on those with lower test scores.
- Participation in higher education also varies among racial/ethnic groups. Whites and Asians of traditional college age are more likely than their black and Hispanic

peers to enroll in higher education institutions. Furthermore, while the gap between blacks and whites has declined, the gap between white and Hispanic high school graduates has grown in the last decade.

- Gaps between individuals who participate and succeed in higher education and those who don't have a major impact on the next generation. The young children of college graduates display higher levels of school readiness indicators than children of noncollege graduates. After they graduate from high school, students whose parents attended college are significantly more likely than those with similar incomes whose parents do not have a college education to go to college themselves.

## 1.9 EDUCATIONAL PLANNING AND ECONOMIC GROWTH

Education Planning in India is one of the essential areas of concern in all the Five year Plans in India. With the onset of globalization and modernization in recent times, education at all levels is very necessary if India is to outdo other nations.

Since the 1990s, the Indian government has been emphasizing the need to develop education in India across all levels - elementary, secondary, vocational, higher level, and technical. Towards this, the government has also formulated certain measures to increase adult literacy and continuing education among Indians.

**Hindrances for Education Planning in India:**

The major problems of the Education Planning in India as far as analysts opine are as under:

- High drop-out rates
- Low levels of learning achievement
- Low participation of girl students
- Inadequate school infrastructure
- Teacher absenteeism rate high
- Large-scale teacher vacancies
- Inadequate teaching/learning material
- Lack of public involvement in provisioning of educational services

- Variation in the literacy rates for the Special Groups of citizens
- Variation in inter-state literacy rates

**Steps taken by government in accelerating Education Planning in India:**

The central as well as the state governments have been emphasizing on the growth of education at all levels. Moreover there are District Literacy Societies or Zilla Saksharta Samiti who also plays the most pivotal role in the pursuance of adult education. The first step taken by the Indian government is to initiate measures for universal elementary education among all. The other significant steps taken on the Education Planning in India are -

- To increase the number of institutions, teachers and students at elementary level
- To provide for incentives like textbooks, free uniforms and scholarships
- To offer Centrally Sponsored Program of Nutritional Support to Primary Education or Mid Day Meal Scheme
- To launch the Sarva Siksha Abhiyan Scheme
- To initiate the District Elementary Education Plan
- To launch the National Literacy Mission for providing functional literacy to the non-literates between the age group of 15 and 35
- To provide free and compulsory education for children
- To improve the Industrial Training Institutes, Boards of Technical Education and Engineering Colleges, and Polytechnology and Apprenticeship Schools
- To upgrade the Indian Institutes of Technology and Indian Institutes of Management
- To progress in new technology based areas like biotechnology, bioinformatics, and nanotechnology

## 1.10 COST BENEFIT ANALYSIS AND EDUCATION

Cost-benefit analysis and cost effectiveness analysis can help us in evaluating the alternative uses of resources. The estimation of a unit cost is necessary, if one has to make a cost-benefit or cost-effectiveness analysis. In a cost-benefit analysis, the output is measured in monetary terms, and in cost-effectiveness analysis, the output is addressed in terms of the level of achievement of the objectives. Cost benefit analysis is also known as

"rate of return" analysis. For example, if a computer printer's cost is Rs. 10.000 to acquire, and yields on annual constant income of Rs. 1200, and has a life expectancy of 10 years, the rate of return of investment on this printer is equal to about 3%. This is found by solving the following equation.

$$C = \frac{B_1}{(1+r)} + \frac{B_2}{(1+r)^2} + \ldots\ldots\ldots + \frac{B_{10}}{(1+r)^{10}}$$

Where,

C =represents the cost of the computer printer,

B = annual benefits, and

r = rate of return.

We can define 'cost benefit' as a tool, which measures, in economic m terms, the benefits of education to the individual or to society. In order to use this technique, it is necessary to measure both the costs and benefits in economic or financial terms. On the other hand, in 'cost effectiveness analysis', the output of education can be measured in terms of scores in cognitive achievement tests, examination results, etc. We can also analyse different types of return given as follows:

**Private rate of return**: A private rate of return is estimated when the benefits and costs refers to the individual undertaking the investment.

**Social rate of return**: It is used for educational planning purposes. The social rate of return on education measures the extent to which the society receives a positive payoff on its investment in education.

## 1.11 EDUCATIONAL FINANCING

The educational system in India is predominantly a state funded and directed activity. Given the financial constraints, India, like many other developing countries, finds it difficult to cope with the ever increasing financial requirements of an expanding system. Reform measures suggested by international agencies and recommended by various committees appointed by the national government have explored possibilities of additional resource mobilization to reduce the burden on the public exchequer.

Most of the reform measures recommended in higher education centre around two major propositions – improving efficiency in the functioning of public institutions on the

one hand, and mobilizing resources from non-governmental sources on the other. The former category of reform measures focus on efficiency in resource use so that more resources are available even when additional resources are not allocated to the sector. Measures like changing the staff-student ratio, increasing the teaching workload, and so on belong to the former category. Measures to diversify the sources of funding or develop alternative arrangements to provide higher education belong to the latter category of reforms. A general trend in these reform measures is to shift the burden of cost from the public to private and household domains.

The report of the Education Commission (1964-66) strongly argued for devoting 6% of the GNP to education. Successive governments in the recent past promised this level of investment but it remains more a political intention than a realized commitment. The Majumdar Committee (mhrd, 1999) recently analysed the financial implications of making elementary education a fundamental right and came to the conclusion that enhancing the share of investment to 6% of the GNP would be sufficient to provide adequate resources at all levels of the education system. India now spends only around 3.7% of its GNP on education, undoubtedly a substantial increase of three times in the share – from 1.2% of the GNP in 1950-51 to 3.7% in the year 1990-91. If the share of education in GNP is increased to 6% it would be sufficient to finance universalization of elementary education and provide more resources for post-compulsory levels of education.

Public expenditure on higher education as a share of GNP increased from 0.19% in 1950-51 to around 0.56% in 1990-91. It needs to be noted that the expenditure on higher education as a share of GNP increased consistently until the 1980s. In fact, in the late '70s India was spending almost one per cent of GNP on higher education. This trend changed in the 1980s and its share reduced to 0.56%. From the mid-1980s onwards, especially after the National Policy on Education, the focus of discussions and priority in allocation shifted towards elementary education.

The share of the central government in total education expenditure increased during the post-policy period, i.e., from the late 1980s. A substantial share of this increased expenditure was, however, allocated to elementary education. Expenditure on higher education as a share of total recurring expenditure on education shows a declining

trend (Varghese and Tilak, 1991). Higher education accounted for 20% of the recurring expenditure on education in the '50s which increased to 29% in the '70s and early '80s; in the decade of the '80s it declined to 18%. As of now, the share of recurring expenditure on higher education is lower than what was in the 1950s. This reduced spending on higher education becomes more marked when one looks into allocation to higher education under successive plans.

Plan allocation to education denotes current priorities and the government's commitment to new initiatives. The Indian evidence shows that allocation to education, in general, declined under successive five year plans. Nearly 7.8% of the total plan funds were allocated to education in the first five year plan. It came down to around 2.7% during the sixth five year plan though it increased to 4.5% in the eighth five year plan. This recent increase is certainly a positive trend.

The first plan accorded a high priority to elementary education and nearly 56% of the allocations were earmarked for this sector. Consequently the share of resources for higher education was only 9%. However, its share in the second plan doubled to 18% reaching a high of 25% in the fourth plan. From the 1970s onwards one finds a consistent decline in the share of allocations to higher education reaching the lowest share of 7% in the eighth plan. The trends clearly indicate that allocation to higher education increased consistently from the first to fourth plans and declined consistently thereafter. However, the argument is not that too many resources were allocated to elementary education; universalization of elementary education requires more resources than what is currently allocated. With the expansion of school education, the pressure on higher education to expand will continue. Since both sectors require more resources, a reprioritization in allocation between primary and higher education keeping the same level of public funding will leave both sectors starved.

Did the government succeed in transferring its financial burden to others? An analysis of the sources of funding for education clearly indicates that in the 1950s only 58% of public expenditure on education came from government sources. Over a period of time the share of government in educational expenditure has increased. Currently, nearly 85% of the educational expenditure comes from government sources – central, state and local. In other words, during the past three decades the total educational expenditure has

increased and more importantly the share of the government to total expenditure has increased.

In 1950-51, the expenditure on higher education was shared equally by the government and private sources. More importantly, fees accounted for nearly 37% of the total recurring expenditure on higher education. However, in 1985-86 (the latest year for which information is available) more than 80% of the expenditure came from government sources. Correspondingly, there was a decline in other sources of funding for higher education. For example, student fees accounted for 36.8% of the total expenditure in the 1950s. Over a period of time the income from fees as a share of total resources for higher education declined and in 1985-86 it accounted for only 14.4% of the total recurring expenditure. This implies that the share of fees in total expenditure declined from over one-third in the 1950s to nearly one-seventh in the 1980s. A similar trend is visible in case of endowments and other sources of income to the universities. Nearly 14% of the total expenditure on higher education came from these sources in 1950-51; it declined to 4.5% in 1985-86.

It is interesting to note that even when there was a decline in public funding for higher education, the nonprofessional courses were more adversely affected than the professional ones (Varghese, 1987). The trends in the financing of higher education in India show that: (*i*) the share of the government in total educational expenditure has increased; (*ii*) the share of higher education in the total public education expenditure has declined, both in plan allocation and in recurring expenditure (This shows a reduced public priority and resource commitment towards higher education, especially in the late 1980s); and (*iii*) student fees and endowments as a share of total resources for higher education have declined. Consequently, the share of government expenditure in total spending on higher education has increased. By the '90s, the government, which is the dominant partner in funding, found it increasingly difficult even to maintain the same level of funding for higher education. Therefore, mobilizing resources from non-government sources became important even to sustain the system of higher education at its present level of operation. Most of the committees appointed during this period have made various suggestions in this regard.

The 1980s was a period of economic crisis in many developing countries. During this period many countries resorted to extensive external funding, primarily through the structural adjustment programmes. Studies have shown that countries which received structural adjustment loans showed declining public expenditure on education (Lewin, 1986, Berstecher and Carr-Hill, 1990; Sanyal, 1992). It was primarily due to the fact that structural adjustment necessitated a redefinition of the role of government and envisaged a reduced government intervention in all sectors, including education.

## Policy Issues (1): On Mobilizing Domestic Resources

- Family investments in education are estimated to be as important and significant as public investments in quantum. The scope for raising families' contributions, voluntary, or compulsory like fees, to education seems to be limited.
- Contributions from the communities should be treated as peripheral sources to supplement the levels of the funding by the government. The core educational activities should not critically depend upon such contributions, and the state must ensure the smooth functioning of the core education activities though its own funding. Excessive reliance on parental and community contributions for basic education will produce serious adverse effects on equity, contributing to inequalities between several groups of population, and between regions, thus finally contributing to under-optimum levels of social investment in education.
- Private schools in general do not necessarily reduce the financial burden of the government. They might even work against financial, educational and other social considerations of the welfare state. Policies encouraging privatization in education need to be made with caution.
- The evidence on decentralization and local financing of primary schools is not conclusive with regard to school effectiveness, and funding. One has to be cautious in laying exclusive stress on decentralization as a panacea for all the problems in educational development in developing countries.
- It may be desirable to have a national norm, applicable to all regions in a country, with regard to, say, the minimum share of the budget that should be allocated to education and to basic education in particular. This will help in promoting balanced development of education in the country.

## Policy Issues (2): On Mobilizing External Resources

- External assistance will play an important catalytic role in the development of education, but it is too much to expect that it will solve the financial problems of education in developing countries substantially.
- Externally aided projects should become sustainable over time.
- The shift in aid programmes in favour of education and more specifically in favour of basic education needs to be strengthened and sustained.
- The undesirable trends in primary education during the process of stabilization and adjustment strongly suggest the need for necessary accompanying of compensatory programmes such as the Social Safety Net programme along with the adjustment loans. It may be better in fact, if the stabilization and adjustment programmes exclude human development sectors
- Jandhyala Tilak: Resource Mobilization for EFA like education from general conditions of budget cuts, and rather includes conditions of strengthening education budgets.
- There exists a threshold level of buildings and other hardware facilities for meaningful education activities to be carried on, and external assistance should make appropriate investments in physical capital, apart from software.
- The needs of the developing countries relating to the nature and type of external assistance vary, and there cannot be a single pattern of external assistance to all developing countries.
  - ¬ Countries with low levels of income and low levels of educational development need to be provided assistance in terms of technical assistance as well as physical (material and direct monetary) inputs.
  - ¬ Countries with low levels of income and reasonably high levels of educational development do not require technical assistance; external aid may be concentrated on direct money inputs, and material support.
  - ¬ Countries with high levels of income and low levels of educational development need to be provided external aid in terms of technical assistance.

- ¬ Countries with high levels of income and high levels of educational development obviously do not require any kind of external assistance for education.

- The efforts of donor agencies in all categories of countries should concentrate on building national capacities, and long term development of education in the country concerned.
- It may be advisable to look at the possibility of providing debt relief, or more clearly swapping the education debts of the poor countries as a means of funding education, like the debt-swaps relating to environment initiated in 1987.
- The international donor community, including the bilateral and multilateral agencies should substantially raise their support for education in developing countries, and may also fix a norm regarding the minimum level of the share of education in their development aid programmes, and the share of basic education in their education aid programmes.

**Table 7Effects of education on society**

| How Education Affects Income | | |
|---|---|---|
| Amount of Education | Median Income for Males | Females |
| Not a High School Graduate | $14,155 | $8,433 |
| High School Graduate | $25,406 | $13,950 |
| Some College | $27,262 | $16,317 |
| Bachelor's Degree | $51,422 | $30,913 |
| Advanced Degree | $81,658 | $45,054 |

Source: Bureau of the Census

Much of the theoretical debate about the role of education in development and economic growth has focused upon whether education is productive in an economic sense. There is much evidence that levels of schooling amongst the population are highly correlated with levels of economic development. But whether the former has helped cause the latter, or whether causality runs from income growth to educational expansion, remains open to debate. An extremely important context, however, for a discussion of poverty is that part of production which takes place outside the formal sector, much of

which is characterized by self-employment in rural and per urban areas. There has therefore been much interest in examining the extent to which education affects production patterns in those activities. It has been shown that primary schooling, for example, helps to increase the productivity of peasant farmers, particularly when they have access to the other inputs needed to enhance their production. It has been shown also that the earnings of the self-employed, including those in urban and informal sector activities, are higher for the educated than for the uneducated. Furthermore, it has been demonstrated that increasing the schooling of women brings beneficial effects for their own control of fertility, for their own health, and that of their families. Human Capital Theory draws links between education and poverty in terms of education as a means of poverty reduction; another significant linkage runs the other way - i.e. the effect of macro- and micro-level poverty on levels of education. At the macro-level, it is generally true that levels of enrolment correlate with GNP. Countries with low per capita GNP tend to have low enrolment ratios. However there are a number of exceptions to this. In Africa, for example, extremely poor countries such as Lesotho, Madagascar and Togo have primary gross enrolment ratios in excess of 100 (Colclough 1994).

Among poor countries there is considerable variation, showing that low GNP does not necessarily translate into low levels of educational enrolment. At the household level evidence suggests that children of poorer households are generally likely to receive less education. Recent debates on poverty have highlighted the need to expand understanding (and measurement) of poverty beyond household income/consumption figures. This is demonstrated by the introduction in the 1996 Human Development Report of the Capability Poverty Measure (CPM ) which includes female education (in the form of female literacy levels) as part of a composite poverty measurement. In this context, education is seen not just as an 'input' to poverty reduction (in the sense of increasing productivity and incomes) but as an asset which can be realized in terms of 'entitlements' (e.g. to labour, capital, social welfare support).

A gender perspective on education suggests attention to the content and value of what schools teach and the kind of environments they provide for girls, not just whether girls attend school or not. Girls' sense of second class citizenship may be reinforced by the school environment, where the curriculum or teacher attitudes perpetuate sexist

stereotypes, or where there is a lack of female role models (Womankind 1995). A number of factors tend to limit the value of formal schooling for girls. For girls in poor households where the opportunity costs of schooling are particularly high, the question of the value of schooling is of pressing importance. Women and girls need the opportunity to learn both basic literacy and numeracy, and a wide range of subjects and skills which challenge stereotypes, e.g. management training, accounting, marketing and machine maintenance. Reform of existing formal education systems can go some way to address these problems. Possible measures include: gender awareness training for teachers and pupils; sex and health education to prevent teenage pregnancy; and curriculum and textbook changes.

The linkages between education and poverty can be understood in two ways:

- Investment in education as a poverty reduction strategy which can enhance the skills and productivity among poor households;
- Poverty as a constraint to educational achievement both at the macro-level (poor countries generally have lower levels of enrolment) and the micro-level (children of poor households receive less education).

Females in developing countries typically receive less education than do males. Although it is generally true those countries with high GNP have greater educational equality for males and females, amongst poor countries there is considerable variation, both in overall levels of enrolment and in female/male enrolment ratios. Female disadvantage in enrolment is thus not simply a matter of overall development. Factors such as social and cultural attitudes, and policy priorities are clearly also significant.

**Activity 1**

1. Discuss how education attained by a person affects his income. What are the policies issues to mobilize domestic and external resources?
2. Explain the concept of human and physical capital. What do you understand by social and private demand of education?
3. Give a brief note on various costs involved in education.
4. What are different benefits of education? Discuss in context of individual and society.

## 1.12 SUMMARY

Education is one of the dominant sectors of the Indian economy in terms of enrolment of children, employment of adults and investment of financial resources. Both physical and human capital directly impact on the productive capacity of an economy concepts are discussed followed by discussing demand for education in perspective of developed and developing nations. Cost of education was the next topic of discussion and was explained along with classification of various costs. Similarly expenditure on education was mystified in the light of various policy issues, social and private cost of education and wastages and stagnations regarding current patterns of education. Next area of consideration was benefits of educational planning followed by educational planning and economic growth. Cost Benefit Analysis unveiled and educational financing was explained in depth to give readers a broad perspective.

## 1.13 FURTHER READINGS


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- King, Robert G., and Ross Levine (1993) "Finance, Entrepreneurship, and Growth: Theory and Evidence" Journal of Monetary Economics 32(3): 513-542.
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# UNIT 2

# ECONOMICS OF HEALTH AND RELATED CONCEPTS

**Objectives**

Upon successful completion of this unit, you should be able to:

- Understand the contribution of health in economic development of nations.
- Know various determinants of health.
- Absorb the approach of demand and supply in health care
- Explain the relevance financing in health care
- Appreciate the concept of human life value
- Describe the theories and empirical studies on production of health care
- Have a quick review of inequalities in health and institutional issues involved.

**Structure**

2.1 Introduction

2.2 Health and development

2.3 Determinants of health

2.4 Health care – the economic dimension

2.5 Demand and supply of health care

2.6 Health care financing

2.7 Human life value

2.8 Production of health care – theories and empirical studies

2.9 Inequalities in health and institutional issues

2.10 Summary

2.11 Further readings

## 2.1 INTRODUCTION

Health economics is a branch of economics concerned with issues related to scarcity in the allocation of health and health care. For example, it is now clear that medical debt is the principle cause of bankruptcy in the United States. In broad terms, health economists study the functioning of the health care system and the private and social causes of health-affecting behaviors such as smoking.

A seminal 1963 article by Kenneth Arrow, often credited with giving rise to the health economics as a discipline, drew conceptual distinctions between health and other goals. Factors that distinguish health economics from other areas include extensive government intervention, intractable uncertainty in several dimensions, asymmetric information, and externalities. Governments tend to regulate the health care industry heavily and also tend to be the largest payer within the market. Uncertainty is intrinsic to health, both in patient outcomes and financial concerns. The knowledge gap that exists between a physician and a patient creates a situation of distinct advantage for the physician, which is called asymmetric information. Externalities arise frequently when considering health and health care, notably in the context of infectious disease. For example, making an effort to avoid catching a cold, or practicing safer sex, affects people other than the decision maker.

## 2.2 HEALTH AND DEVELOPMENT

Better health is central to human happiness and well-being. It also makes an important contribution to economic progress, as healthy populations live longer, are more productive, and save more.

Many factors influence health status and a country's ability to provide quality health services for its people. Ministries of health are important actors, but so are other government departments, donor organizations, civil society groups and communities themselves. For example: investments in roads can improve access to health services; inflation targets can constrain health spending; and civil service reform can create opportunities - or limits - to hiring more health workers.

WHO's work on 'Health and development' tries to make sense of these complex links. It is concerned with the impact of better health on development and poverty reduction, and conversely, with the impact of development policies on the achievement of health goals. In particular, it aims to build support across government for higher levels of investment in health, and to ensure that health is prioritized within overall economic and development plans. In this context, 'health and development' work supports health

policies that respond to the needs of the poorest groups. WHO also works with donors to ensure that aid for health is adequate, effective and targeted at priority health problems.

Health as a basic human value is particularly important to people in the developing world. Rates of economic development lower than had been hoped for and ever more steeply rising population growth have precipitated a reaction against public health programs. Among economists, agriculturalists, and even health professionals the philosophy arose that one should "hold back" on using modern weapons against disease because they are "too effective." To satisfy the recognized popular demand, simple and relatively ineffective measures of curative medicine could be substituted. It was said that the emphasis should be, instead, on agriculture, community development, education, and industrialization and that family planning should be pushed as a separate program. Documentation presented here sharply challenges such a point of view. No segment of the total development process can be effective without the other sectors.

Good health plays a substantial role in economic growth. A long-term study for England carried out by Robert Fogel, a Nobel Prize winner in Economics, clearly demonstrates this. Studies on the role that health plays in growth from more than a century of history in currently developed countries confirm this as well In Latin America, it has also been confirmed that life expectancy has an important correlation with income. In Mexico, a similar assertion can be made. A better understanding of the magnitude of this relationship and the mechanisms under which it operates would allow the design and implementation of more efficient policies for the sake of improving population's health and economic development in general In order to explain the relationship between health and economic growth, it is necessary to understand the concept of health in a broad sense.

Health is not only the absence of illnesses; it is also the ability of people to develop to their potential during their entire lives. In that sense, health is an asset individuals possess, which has intrinsic value (being healthy is a very important source of well-being) as well as instrumental value. In instrumental terms, health impacts economic growth in a number of ways. For example, it reduces production losses due to worker illness, increases the productivity of adult as a result of better nutrition, and it lowers absenteeism rates and improves learning among school children. Health also allows for

the use of natural resources that used to be totally or partially inaccessible due to illnesses.

Finally, it permits the different use of financial resources that might normally be destined for the treatment of ill health. In sum, health affects economic growth directly through labor productivity and the economic burden of illnesses, for example. Health also indirectly impacts economic growth since aspects such as child health affect the future income of people through the impact health has on education. This indirect impact is easier to understand if it is observed on a family level. When a family is healthy, both the mother and the father can hold a job, earn money which allows them to feed, protect and send their children to school.

Healthy and well-nourished children will perform better in school and a better performance in school will positively impact their future income. If parents ensure that their children have a high probability of reaching adulthood, in general they will have fewer children and they will be able to invest more in health and education for each of them. Additionally, the loss of health affects the poor to a greater extent since the main, and at times, only asset they have is their body. When they become ill they have fewer alternative solutions and suffer greater consequences the results of historical studies suggest a very strong relationship between health and economic growth.

Robert W. Fogel finds that between one third and one half of England's economic growth in the past 200 years is due to improvements in the population's food consumption.

## 2.3 DETERMINANTS OF HEALTH

Even in the most affluent countries, people who are less well off have substantially shorter life expectancies and more illnesses than the rich. Not only are these differences in health an important social injustice, they have also drawn scientific attention to some of the most powerful determinants of health standards in modern societies. They have led in particular to a growing understanding of the remarkable sensitivity of health to the social environment and to what have become known as the determinants of health poverty

**1. The social gradient**

Poor social and economic circumstances affect health throughout life. People further down the social ladder usually run at least twice the risk of serious illness and premature death as those near the top. Nor are the effects confined to the poor. the social gradient in health runs right across society, so that even among middle-class office workers, lower ranking staff suffer much more disease and earlier death than higher ranking staff Both material and psychosocial causes contribute to these differences and their effects extend to most diseases and causes of death.

**2. Stress**

Social and psychological circumstances can cause long-term stress. Continuing anxiety, insecurity, low self-esteem, social isolation and lack of control over work and home life, have powerful effects on health. Such psychosocial risks accumulate during life and increase the chances of poor mental health and premature death. Long periods of anxiety and insecurity and the lack of supportive friendships are damaging in whatever area of life they arise. The lower people are in the social hierarchy of industrialized countries, the more common these problems become.

**3. Early life**

Observational research and intervention studies show that the foundations of adult health are laid in early childhood and before birth. Slow growth and poor emotional support raise the lifetime risk of poor physical health and reduce physical, cognitive and emotional functioning in adulthood. Poor early experience and slow growth become embedded in biology during the processes of development, and form the basis of the individual's health because of the continued malleability of biological systems. As cognitive, emotional and sensory inputs programme the brain's responses, insecure emotional attachment and poor stimulation can lead to reduced readiness for school, low educational attainment, and problem behaviour, and the risk of social marginalization in adulthood.

Good health-related habits, such as eating sensibly, exercising and not smocking, are associated with parental and peer group examples, and with good education. Slow or retarded physical growth in infancy is associated with reduced cardiovascular, respiratory, pancreatic and kidney development and function, which increase the risk of illness in adulthood. Poor circumstances during pregnancy can lead to less than optimal

fetal development via a chain that may include deficiencies in nutrition during pregnancy, maternal stress, a greater likelihood of maternal smoking and misuse of drugs and alcohol, insufficient exercise and inadequate prenatal care.

**4. Poverty and social exclusion**

Poverty, relative deprivation and social exclusion have a major impact on health and premature death, and the chances of living in poverty are loaded heavily against some social groups. Absolute poverty – a lack of the basic material necessities of life – continues to exist, even in the richest countries of Europe. The unemployed, many ethnic minority groups, guest workers, disabled people, refugees and homeless people are at particular risk. Those living on the streets suffer the highest rates of premature death.

Relative poverty means being much poorer than most people in society and is often defined as living on less than 60% of the national median income. It denies people access to decent housing, education, transport and other factors vital to full participation in life. Being excluded from the life of society and treated as less than equal leads to worse health and greater risks of premature death. The stresses of living in poverty are particularly harmful during pregnancy, to babies, children and old people. In some countries, as much as one quarter of the total population and a higher proportion of children live in relative poverty.

Social exclusion also results from racism, discrimination, stigmatization, hostility and unemployment. These processes prevent people from participating in education or training, and gaining access to services and citizenship activities. They are socially and psychologically damaging, materially costly, and harmful to health. People who live in, or have left, institutions, such as prisons, children's homes and psychiatric hospitals, are particularly vulnerable.

**5. Work**

In general, having a job is better for health than having no job. But the social organization of work, management styles and social relationships in the workplace all matter for health. Evidence shows that stress at work plays an important role in contributing to the large social status differences in health, sickness absence and premature death. Several European workplace studies show that health suffers when people have little opportunity to use their skills and low decision-making authority.

Having little control over one's work is particularly strongly related to an increased risk of low back pain, sickness absence and cardiovascular disease. These risks have been found to be independent of the psychological characteristics of the people studied. In short, they seem to be related to the work environment. Studies have also examined the role of work demands. Some show an interaction between demands and control. Jobs with both high demand and low control carry special risk. Some evidence indicates that social support in the workplace may be protective.

**6. Unemployment**

Unemployment puts health at risk, and the risk is higher in regions where unemployment is widespread. Evidence from a number of countries shows that, even after allowing for other factors, unemployed people and their families suffer a substantially increased risk of premature death. The health effects of unemployment are linked to both its psychological consequences and effects on mental health (particularly anxiety and depression), self-reported ill health, heart disease and risk factors for heart disease. Because very unsatisfactory or insecure jobs can be as harmful as unemployment, merely having a job will not always protect physical and mental health: job quality is also important. During the 1990s, changes in the economies and labour markets of many industrialized countries increased feelings of job insecurity. As job insecurity continues, it acts as a chronic stressor whose effects grow with the length of exposure; it increases sickness absence and health service use.

**7. Social support**

Social support and good social relations make an important contribution to health. Social support helps give people the emotional and practical resources they need. Belonging to a social network of communication and mutual obligation makes people feel cared for, loved, esteemed and valued. This has a powerful protective effect on health. Supportive relationships may also encourage healthier behaviour patterns. Support operates on the levels both of the individual and of society. Social isolation and exclusion are associated with increased rates of premature death and poorer chances of survival after a heart attack People who get less social and emotional support from others are more likely to experience less well-being, more depression, a greater risk of pregnancy complications and higher levels of disability from chronic diseases. In addition, bad close relationships can lead to poor mental and physical health.

**8. Addiction**

Drug use is both a response to social breakdown and an important factor in worsening the resulting inequalities in health. It offers users a mirage of escape from adversity and stress, but only makes their problems worse. Alcohol dependence, illicit drug use and cigarette smoking are all closely associated with markers of social and economic disadvantage. In some of the transition economies of central and Eastern Europe, for example, the past decade has been a time of great social upheaval. Consequently, deaths linked to alcohol use – such as accidents, violence, poisoning, injury and suicide – have risen sharply. Alcohol dependence is associated with violent death in other countries too.

**9. Food**

A good diet and adequate food supply are central for promoting health and well-being. Shortage of food results in malnutrition and deficiency diseases. Excess intake (also a form of malnutrition) contributes to cardiovascular diseases, diabetes, cancer, degenerative eye diseases, obesity and dental caries. Food poverty exists side by side with food plenty. The important public health issue is the availability and cost of healthy, nutritious food.

Malnutrition is the insufficient, excessive or imbalanced consumption of nutrients. A number of different nutrition disorders may arise, depending on which nutrients are under or overabundant in the diet. The World Health Organization cites hunger as the gravest single threat to the world's public health. Malnutrition is, by far, the biggest contributor to child mortality, present in half of all cases. Malnutrition, in the form of iodine deficiency, is the most common preventable cause of mental impairment. Improving nutrition is widely regarded as the most effective form of aid Access to good, affordable food makes more difference to what Social and economic conditions result in a social gradient in diet quality that contributes to health inequalities. The main dietary difference between social classes is the source of nutrients. In many countries, the poor tend to substitute cheaper processed foods for fresh food. High fat intakes often occur in all social groups. People on low incomes, such as young families, elderly people and the unemployed, are least able to eat well.

Dietary goals to prevent chronic diseases emphasize eating more fresh vegetables, fruits and pulses (legumes) and more minimally processed starchy foods, but less animal fat, refined sugars and salt. Over 100 expert committees have agreed on these dietary goals. People eat than health education. Economic growth and improvements in housing and sanitation brought with them the epidemiological transition from infectious to chronic diseases – including heart disease, stroke and cancer. With it came a nutritional transition, when diets, particularly in Western Europe, changed to over consumption of energy-dense fats and sugars, producing more obesity. At the same time, obesity became more common among the poor than the rich.

**10. Transport**

Cycling, walking and the use of public transport promote health in four ways. They provide exercise, reduce fatal accidents, increase social contact and reduce air pollution.

Because mechanization has reduced the exercise involved in jobs and house work and added to the growing epidemic of obesity, people need to find new ways of building exercise into their lives. Transport policy can play a key role in combating sedentary lifestyles by reducing reliance on cars, increasing walking and cycling, and expanding public transport. Regular exercise protects against heart disease and, by limiting obesity, reduces the onset of diabetes. It promotes a sense of well-being and protects older people from depression.

Reducing road traffic would also reduce the toll of road deaths and serious accidents. Although accidents involving cars also injure cyclists and pedestrians, those involving cyclists injure relatively few people. Well planned urban environments, which separate cyclists and pedestrians from car traffic, increase the safety of cycling and walking. In contrast to cars, which insulate people from each other, cycling, walking and public transport stimulate social interaction on the streets. Road traffic cuts communities in two and divides one side of the street from the other. With fewer pedestrians, streets cease to be social spaces and isolated pedestrians may fear attack. Further, suburbs that depend on cars for access isolate people without cars – particularly the young and old. Social isolation and lack of community interaction are strongly associated with poorer health.

## 2.4 HEALTH CARE – THE ECONOMIC DIMENSION

The scope of health economics is netly encapsulated by Alan Williams' "plumbing diagram" dividing the discipline into eight distinct topics:

- What influences health? (other than health care)
- What is health and what is its value
- The demand for health care
- The supply of health care
- Micro-economic evaluation at treatment level
- Market equilibrium
- Evaluation at whole system level; and,
- Planning, budgeting and monitoring mechanisms.

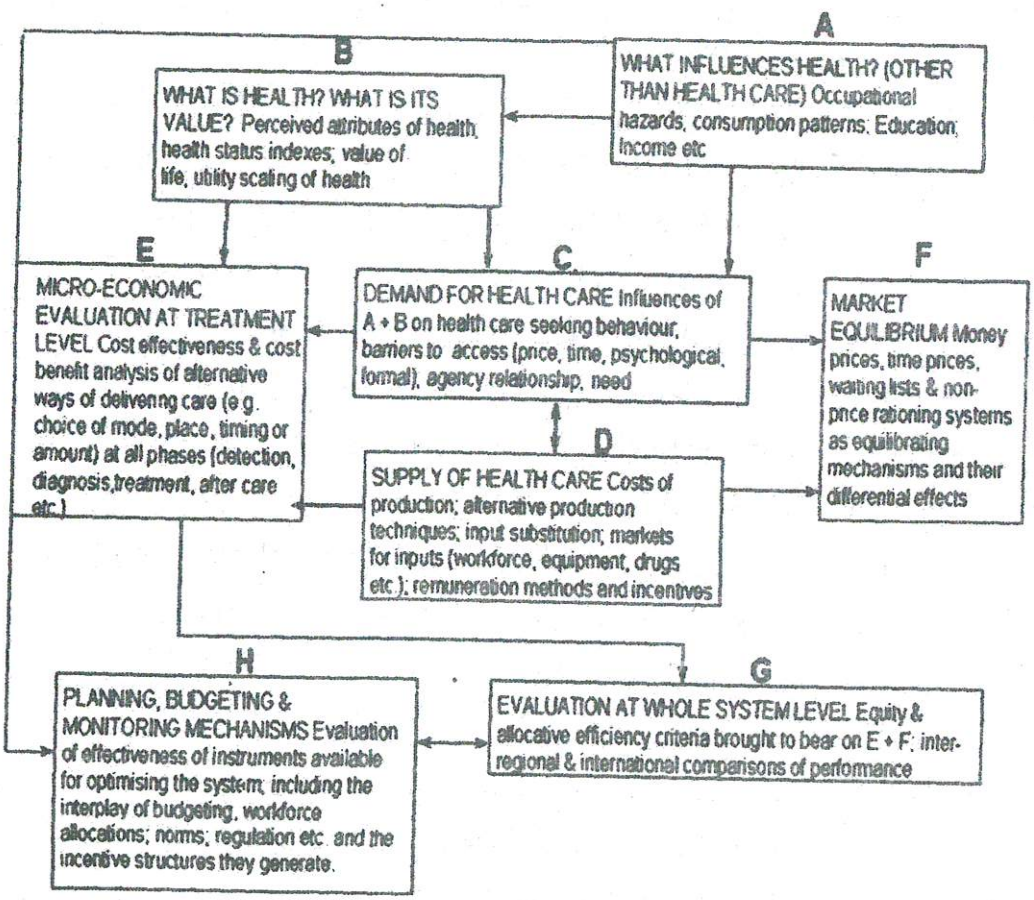


Figure 1

## Health care markets

**The five health markets typically analyzed are:**

- Health care financing market
- Physician and nurses services market
- Institutional services market
- Input factors market
- Professional education market

Although assumptions of textbook models of economic markets apply reasonably well to health care markets, there are important deviations. Insurance markets rely on risk pools, in which relatively healthy enrollees subsidize the care of the rest. Insurers must cope with adverse selection which occurs when they are unable to fully predict the medical expenses of enrollees; adverse selection can destroy the risk pool. Features of insurance markets, such as group purchases and preexisting condition exclusions are meant to cope with adverse selection.

Insured patients are naturally less concerned about health care costs than they would if they paid the full price of care. The resulting moral hazard drives up costs, as shown by the famous RAND Health Insurance Experiment. Insurers use several techniques to limit the costs of moral hazard, including imposing co-payments on patients and limiting physician incentives to provide costly care. Insurers often compete by their choice of service offerings, cost sharing requirements, and limitations on physicians.

Consumers in health care markets often suffer from a lack of adequate information about what services they need to buy and which providers offer the best value proposition. Health economists have documented a problem with supplier induced demand, whereby providers base treatment recommendations on economic, rather than medical criteria. Researchers have also documented substantial "practice variations", whereby the treatment a patient receives depends as much on which doctor they visit as it does on their condition. Both private insurers and government payers use a variety of controls on service availability to rein in inducement and practice variations.

The U.S. health care market has relied extensively on competition to control costs and improve quality. Critics question whether problems with adverse selection, moral hazard, information asymmetries, demand inducement, and practice variations can be

addressed by private markets. Competition has fostered reductions in prices, but consolidation by providers and, to a lesser extent, insurers, has tempered this effect.

Though the market for health care in the U.S. is primarily coordinated by competition, there is an abundance of regulations that inhibit market efficiency. A classic example is medical licenses. Some economists argue that requiring doctors to have a medical license constrains inputs, inhibits innovation, and increases cost to consumers while largely only benefiting the doctors themselves.

**Competitive equilibrium in the five health markets**

While the nature of health care as a private good is preserved in the last three markets, market failures occur in the financing and delivery markets due to two reasons: (1) Perfect information about price products is not a viable assumption (2) Various barriers of entry exist in the financing markets (i.e. monopoly formations in the insurance industry)

**Ideological bias in the debate about the financing and delivery health markets**

The health care debate in public policy is often informed by ideology and not sound economic theory. Often, politicians subscribe to a moral order system or belief about the role of governments in public life that guides biases towards provision of health care as well. The ideological spectrum spans: individual savings accounts and catastrophic coverage, tax credit or voucher programs combined with group purchasing arrangements, and expansions of public-sector health insurance. These approaches are advocated by health care conservatives, moderates and liberals, respectively.

***Other issues***

**Medical economics**

Often used synonymously with Health Economics, ***Medical economics***, according to Culyer, is the branch of economics concerned with the application of economic theory to phenomena and problems associated typically with the second and third health market outlined above. Typically, however, it pertains to cost-benefit analysis of pharmaceutical products and cost-effectiveness of various medical treatments. Medical economics often uses mathematical models to synthesise data from biostatistics and epidemiology for support of medical decision making, both for individuals and for wider health policy.

### Behavioral economics

Peter Orszag has suggested that behavioral economics is an important factor for improving the health care system, but that relatively little progress has been made when compared to retirement policy.

## 2.5 DEMAND AND SUPPLY OF HEALTH CARE

The demand for health care is a derived demand from the demand for health. Health care is demanded as a means for consumers to achieve a larger stock of "health capital." The demand for health is unlike most other goods because individuals allocate resources in order to both consume and produce health.

Michael Grossman's 1972 model of health production has been extremely influential in this field of study and has several unique elements that make it notable. Grossman's model views each individual as both a producer and a consumer of health. Health is treated as a stock which degrades over time in the absence of "investments" in health, so that health is viewed as a sort of capital. The model acknowledges that health care is both a consumption good that yields direct satisfaction and utility, and an investment good, which yields satisfaction to consumers indirectly through increased productivity, fewer sick days, and higher wages. Investment in health is costly as consumers must trade off time and resources devoted to health, such as exercising at a local gym, against other goals. These factors are used to determine the optimal level of health that an individual will demand. The model makes predictions over the effects of changes in prices of health care and other goods, labour market outcomes such as employment and wages, and technological changes. These predictions and other predictions from models extending Grossman's 1972 paper form the basis of much of the econometric research conducted by health economists.

In Grossman's model, the optimal level of investment in health occurs where the marginal cost of health capital is equal to the marginal benefit. With the passing of time, health depreciates at some rate δ. The interest rate faced by the consumer is denoted by r. The marginal cost of health capital can be found by adding these variables: $MC_{HK} = r + \delta$. The marginal benefit of health capital is the rate of return from this capital in both market and non-market sectors. In this model, the optimal health stock can

be impacted by factors like age, wages and education. As an example, $\delta$increases with age, so it becomes more and more costly to attain the same level of health capital or health stock as one ages. Age also decreases the marginal benefit of health stock. The optimal health stock will therefore decrease as one ages.

Virtually all economists who have analysed the health sector agree that it raises some unusual problems. As a minimum, orthodox economists generally agree that when patients are sheltered from the cost of health services by health insurance there will be an increase in demand 'moral hazard' and that the removal of demand side restraints will make the outcome of the otherwise competitive market problematical. The conclusion does not depend upon the assumption that health care and health insurance have a special role in the achievement of social justice although this is almost certainly true. Unregulated competitive markets result in private health insurance and the effect upon moral hazard does not depend upon the reason for the health insurance. With either public or private insurance there will be a trade-off between objectives

Many these days are attributing to the cost of healthcare as a supply demand issue and want the market forces to take their own course. These are the people who tend to miss the point that healthcare market has been rarely about open market conditions. The healthcare is heavily lobbied industry. Till recently, American Medical Association and other industry groups reported over supply of doctors. They lobbied hard.

The marketplace doesn't determine how many doctors the nation has, as it does for engineers, pilots and other professions. The number of doctors is a political decision, heavily influenced by doctors themselves. Congress controls the supply of physicians by how much federal funding it provides for medical residencies — the graduate training required of all doctors. AMA predicted in 1994 that by year 2000, there will be suplus of over 150,000 doctors. It did not happen. While it seems like a simple analysis to understand the need (or no need) of doctors, still it remains a mystery. The organizations that used to predict over supply are now predicting shortage. They were not right then, so what makes them right now!

"The truth is, we don't know if there's a shortage of physicians," says AMA President John Nelson, a Salt Lake City obstetrician. "It looks like there are enough physicians for the short term, but maybe we need more because of the aging population." . Some medical policy specialists say the USA doesn't have too few doctors, just poor distribution of them.

"It's wrong to think that we can produce more physicians and have them trickle down to where they are needed," says Grumbach, who favors a government-run, national health care system. "Investing billions of dollars to produce more doctors is a foolish way to spend money."

Others worry that more physicians will drive up the cost of medical care, not make it cheaper and more accessible. Physicians will order more tests, more procedures and more drugs — without improving the nation's health, they say.

Demographic changes in the medical profession also contribute to the need for more physicians. Nearly half of new physicians are women, and studies show they work an average of 25% fewer hours than male physicians, Cooper says.

Physicians older than 55 years, work about 15% less than younger doctors. And medical residents have been limited to 80-hour weeks since 2003, ending decades of 100-plus-hour weeks.

All seem to agree that there is shortage of physicians. I think the problem is not the shortage but is of changing habits. The salaries have risen but the work hours have gone down.

Of course they will have shortage of physicians if they do not work full hours. Of course, we will have shortage of physicians if AMA lobbies to control the number of seats.

## 2.6 HEALTH CARE FINANCING

The nature of financing defines the structure, the behaviour of different stakeholders and quality of outcomes. It is closely and indivisibly linked to the provisioning of services and helps define the outer boundaries of the system's capability to achieve its stated goals. Health financing is by a number of sources: (i) the tax-based public sector that comprises local, State and Central Governments, in addition to

numerous autonomous public sector bodies; (ii) the private sector including the not-for-profit sector, organizing and financing, directly or through insurance, the health care of their employees and target populations; (iii) households through out-of-pocket expenditures, including user fees paid in public facilities; (iv) other insurance-social and community based; and (v) external financing (through grants and loans). While taxation is considered the most equitable system of financing, as tax is a means of mobilizing resources from the richer sections to finance the health needs of the poor, out-of-pocket expenditures by households is considered the most inequitable.

Under a system dominated by out-of-pocket expenditures, the poor, who have the greater probability of falling ill due to poor nutrition, unhealthy living conditions, etc. pay disproportionately more on health than the rich and access to health care is dependent on ability to pay. Assessing how pro-poor a system of financing is again depends on how the different types of financing interact with each other. For example, a country may have a social health insurance policy but may not cover public hospitals as they are in theory expected to provide free care. In such a situation there may be greater incentives for patients to go to private hospitals as expenses are covered by insurance resulting in no incentives for the public hospitals to function well. In that case, the poor who have no immediate access to insurance or private hospitals may stand to lose with poor quality public care.

In India, as in most countries, there is a clear urban-rural, rich-poor divide. Affluent sections, urban populations and those working in the organized sector covered under some form of social security such as the ESIS or CGHS, have unlimited access to medical services. The rural population and those working in the unorganized sector have only the tax-based public facilities to depend on for free or subsidized care, and private facilities depending on their ability to pay. The impact on equity then gets determined on whether the tax-based public facilities are able to provide a similar quality of care as provided under the Social Health Insurance Scheme. Because, if funding is low and the quality of care falls below expectation, is inaccessible, entails informal payments, etc. then the benefit of free care at the public facility gets neutralized with the second option of paying out-of-pocket to a relatively hassle free private provider available close by, making the system of financing inequitable as well as inefficient.

**Health Spending in India**

Health spending in India is estimated to be in the range of 4.5%-6%. These estimates are based on a weak methodological background. Therefore, an exercise was undertaken to construct estimates of health spending based on a National Health Account (NHA) framework. Such an approach enables a better and more reliable understanding of the size and structure of health financing in India. Results from the NHA show that the estimated health expenditure in India for the year 2001-02 was approximately Rs 108,732 crore, accounting for 4.8% of the GDP at current market price, while health expenditure as a percentage of the GDP measured at factor cost worked out to 5.2%. Out of this, Central, State and local Governments together spend one-fourth of the total health expenditure. The share of other central ministries, which include railways, defense, posts and telegraphs, other civil ministries, etc., is estimated to be about 2.42% of total health spending in the country.

The estimate is based on direct spending by the ministries as well as reimbursements provided to its employees. Local governments' resources for health are through transfers from State Governments and their own resources. An estimated 2.2 % of total health spending comes from the local government. The estimate involves only spending by municipalities and not Panchayati Raj institutions. It is to be noted that municipalities (in metros and particularly Mumbai Municipal Corporation) are major contributors among local governments while the share of Panchayati Raj institutions are a miniscule part of the health budget, since a substantial part of the panchayat's are mostly composed of either Central or State transfers. Regarding private spending on health, the NHA matrix reveals that 71% of the health budget is contributed by private sector, of which households alone spend 69%.

**Household Out-of-Pocket Expenditure on Health**

The dominant role of the private sector in Indian health care system is well known, both in health provision and financing. India is one among the developing countries where households spend a disproportionate share of their consumption expenditure on health care, with the Government's contribution being minimal. Household consumer expenditure data of various rounds of the National Sample Survey Organization (NSSO) suggest that households spend about 5%-6% of their total

consumption expenditure on health and nearly 11% of all non-food consumption expenditure. The analysis here shows the estimate of household expenditure on health for the year 2001-02, using the NHA framework. The estimate is based on the utilization pattern of health facilities and the expenditure involved by different sources of care and services provided.

**Public Financing of Health**

Even though public sector spending accounts for less than a quarter of the total health spending in India, it has a major role in terms of planning, regulating and shaping the delivery of health services. Such public provisioning is considered essential to achieve equity and to address the large positive externalities associated with health. As a result, a vast and widespread public health system grew over time across the country; there were 137,311 subcentres, 22,842 PHCs, 3043 CHCs, 4048 hospitals and a workforce of 345,514 in 2001-02.

The way in which the sector is financed determines the effectiveness of service delivery and requires an understanding of the financing mechanisms in this sector. Health being a State subject, the sector is financed primarily by the State Governments. The per capita total health spending was estimated to be around US$23 during 1997- 2000 (World Bank 2003). As compared to the levels of spending by countries such as Sri Lanka (US$31) and Thailand (US$71), the spending in India is substantially low. A breakdown of health expenditure reveals that expenditure by the public sector in these countries is twice that of India. Substantially higher levels of health outcomes in these countries as compared to India clearly indicate that there is a strong case to markedly increase public sector spending on health, as stated in the National Health Policy 2002 and the National Common Minimum Programme (CMP) 2004. The primary source of public financing is the general tax and non-tax revenues. These include grants and loans received from both internal and external agencies, which face competing demands from various ministries and departments. This pool of resources is used to finance the Centre's and States' own programmes.

The Central Government plays a catalytic role in aligning the States' health programmes to meet certain national health goals through various policy guidelines as well as financing certain critical components of centrally sponsored programmes

implemented by the State Governments. In addition to tax revenues, a meager amount is also raised through user charges, fees and fines from the sector, and further supplemented through grants and loans received from external sources. In the case of local governments, the respective State Governments largely finance their health programmes. Local governments do raise resources through user charges and certain fees though the quantum varies widely from States to States. Overall, the sector is under funded, not without consequences an issue that is often raised in the context of inadequacy of resources to the sector is the efficiency of the resources allocated. The current level of funding to the sector is grossly inadequate as brought out by various studies over the past decade or so.

A concern that is equally voiced is how judiciously the funds allocated currently are utilized. Countries such as Bangladesh and Indonesia spend about US$14 and US$19, respectively, per capita on health; relatively less than the per capita spending by India (US$23). But the health outcomes in terms of child mortality are considerably better in these countries-74 for Bangladesh and 45 for Indonesia compared to 93 for India (World Bank 2003). This clearly reveals that the current level of spending has the potential to improve the outcomes if properly allocated

**Centralization of funds and inadequate capital expenditures**

The Ministry implements certain schemes such as the Central Government Health Scheme (CGHS), national disease control programmes, etc. by itself, and other schemes through the State Governments. A large part of the Ministry's budget is passed on as grants-in-aid to States for implementing various national health programmes. Such transfers accounted for about 43% of the total budget of the Ministry in 2003- 04. Even though the size of the Central health budget has grown considerably from Rs 1670 crore in 1991-92 to Rs 7851 crore in 2003-04, transfers to States as a proportion of the total budget of the Ministry declined sharply from nearly 57% to 44%. This in effect reveals the increasing role that the Central Government has been assuming in health service delivery. As a result, roles such as stewardship and governance that the Central Government is expected to play are undermined.

The share of the Central Government expenditure on health, including grant-in-aid to States, constitutes over a third of the combined expenditure by the States' and Centre. Despite this, there was a sharp decline in capital expenditure, which fell from about one-fourth of the Ministry's expenditure to

less than 6.7% of the net MoHFW expenditure (excluding grant-in-aid to States and UTs but including capital expenditure incurred by the .Ministry of Urban Development on hospitals such as RML and LHMC). During the same time, allocations for materials and supplies for central sector public hospitals also fell from 22% to 15% to accommodate the increase in salaries from 56% to 63% on account of the Fifth Pay Commission. This has had an adverse impact on the declining level of quality in these once premier hospitals which are expected to act as a benchmark in the quality of care.

**Financing of National Programmes-not as per need**

Financing of disease control programmes are affected through societies created for the specific programmes at State and district levels. The mechanism for allocating funds directly to district societies was found to be effective as it enabled quicker absorption of funds. However, there has been a measure of skepticism. For instance, it was envisaged that such decentralization of funds to district societies would enable need based, bottom-up programme planning and budgeting.

However, this seldom happened. Most programmes are designed at the Centre and funds are released with strict guidelines and well-defined budget line items, not very different from for regular health programmes except that the unspent budget does not lapse at the end of the fiscal year. In addition, these programmes have little flexibility in issues such as contracting selected services or procurement of critical supplies.

More importantly, analysis showed that in a number of instances budget allocations are not need-based and in consonance while the disease burden and caseload under leprosy in Bihar was 21.3% of total cases, the State received only 9.4% of the funds, while West Bengal having a caseload of 7.5% got over 10% of the allocation. Likewise, UP and MP together accounted for 37% of the total caseload under child morbidity but received only 24% of the total budget for RCH.

**Gross under funding of National Health Programmes: A mismatch between policy and practice**

Policy governing the National Health Programmes is that services being provided under them are free for all. Theoretically, therefore, regardless of income class, all citizens of the country are eligible for availing of services free of cost under the NHP that cover vector-borne diseases, TB, leprosy, Family Welfare, cataract blindness and HIV/AIDS. Our calculations show that such a policy would need a minimum of Rs 12,000 crore against which the total amount that is spent by the Centre and States on these programmes is about Rs 5000. The suboptimal functioning of the delivery system due to gross under funding explains the huge out-of-pocket expenditures being incurred by individual households in seeking services 'guaranteed' to them under the NHP.

A survey of households conducted by the IIHMR, Jaipur (IIHMR 2000) showed that a married woman in the age group of 15-49 years of age spent an average of Rs 400 for RCH serv ices, with urban households spending Rs 604 and rural households about Rs 292. Of this, Rs 835 was spent for delivery, Rs 440 for RTI treatment and Rs 160 for child care. Similar studies show that the reluctance of women for institutional deliveries and the persistently high proportion of domiciliary deliveries are driven by cost factors.

A delivery in a public hospital is reported to cost an average of Rs 601 while in the private sector it costs about Rs 3593, while at home it costs only Rs 93. The major item of expenditure was also found to be drugs, which constitute 62%. Such findings are not surprising as government spending on RCH is very low. Of the Centre's total FW budget during the period 1997-98 to 2003- 04, the amount for activities directly impacting on maternal health was Rs 2531 crores accounting for 9.7% of the total budget and Rs 17 per capita per annum for women in the age group of 15-49 years of age. Thus, it is clear that if we are to achieve the National Goals of IMR and MMR, there is a need to step up public spending and also develop social health insurance schemes to address the financial barriers that hinder women from seeking good quality care.

## 2.7 HUMAN LIFE VALUE

Every human in this world is valuable and priceless to himself and his family. An attempt to quantify the value for human life may sound ridiculous. But it becomes the

foremost job of an underwriter to evaluate a human life in terms of money, in order to restrict the amount of insurance that can be provided to a person. Every person on this earth would like to insure himself for a maximum possible limit and it is the job of the insurance company to cut a line for this limit and all the more important is to safeguard from under-insurance problems, which countries like America are facing now.

## Concept of Human Life Value

Let us assume that a person purchases a car insurance of Rs.100000/- ($2500) for a car which is worth Rs.800000/- ($20000). The car meets with an accident and is totally damaged. Even if the insurance company honors his claim fully, he will get only Rs.100000 ($2500). With this amount will he be able to purchase the same car which he was having before the accident? The answer to this question would be 'No', because he has not insured his car for its gross worth. In simple terms, the car was not insured for what it was worth, but under-insured thereby defeating the "Principle of Indemnity". Under-insurance at times leaves no trace of insurance when it fails to serve the purpose for what it was effected. In the same way insurance on Human Life should be sought keeping in mind, the financial loss that the family would suffer in the absence of this person and that should be the amount of insurance. Instead of buying Life insurance policies as a tool for reducing tax liability, provision for old age, to venture into stock markets on a small scale etc, it would make sense if insurance is sought from the angle of economic replacement of human life value.

Human Life Value concept was founded by Dr. Solomon S. Huebner, the founder of 'The American College of Life Underwriters', in the 1920's. HLV concept is used by various professionals like Underwriters, Courts, etc. for determining the economic value for a Human Life. For the victims of the 'Terrorist attack of September 11, 2001' on the twin towers, courts decided the amount of settlement based on this concept. Insurance Companies use what is known as HUMAN LIFE VALUE concept for computing the economic value of a person to his family. The amount that the family would require to retain the same standard of living in the absence of a person will be his financial value to the family. On the contrary the financial loss of the family on the death of the person is his value to his family. This would be the maximum amount for which a person can seek insurance protection.

Basically, human life value is based on the individual's earning ability. It is the amount that the family will lose in his absence. By applying what is called as Human Life value concept, the amount of financial support given by the person to his family is determined.

Computation of Human Life value requires a detailed analysis of many factors. Some of them are -

1. Annual Income of the life
2. Balance of active earning period till retirement
3. Personal Expenses
4. Inflation
5. Future increase in salary, etc.

The first step towards computation of Human life value would be to determine the net annual income of the person after deducting the amount spent by him for his personal use like premium for insurance policies, maintenance expense, income tax, etc. This amount will be the amount that he affords to his family annually. The economic value of this life again depends on the length of his active earning period. Let us assume that the person is 25 years of age and his annual income after deducting all his personal and other expenses sums up to Rs.200,000 (around $5000).

Assuming that he would continue with the existing job till his retirement up to an age of 55 years, then his income to his family will continue for 30 years, provided he survives till retirement. So, if he survives to his retirement, then the family would get Rs.200,000 for 30 years, ie. 200,000 * 30 = 6,000,000 ($150,000). This will be the amount that the family will lose on his premature death. The value thus arrived would be the logical amount for which a person needs to insure himself, should he want his family to maintain the same status of living in his absence. But this again depends on his repaying capacity, that is his ability to pay premium for the Insurance policy for an amount of Rs.6, 000,000 ($150,000), keeping in mind his present family requirements and circumstances.

## Methods of HLV computation

### Method - I: Income Replacement Value

This is one of the basic methods of insurance calculation and is based on current annual income:

Insurance needs = annual income * number of years left for retirement.

If the annual income is Rs.100000 ($2500) and the age is say 35 years. Assuming the retirement age as 60 years the balance years of service is 25 years.

Insurance value = 100000 * 25 = 25,00,000 lacs ($62500).

**Method II: Fixed Multiplier**

Another method of insurance calculation is by applying a fixed multiplier on the annual income. Multiplier based on the age of the individual.

| Age range | Multiplier |
|---|---|
| 20 - 30 | 20 |
| 31 - 40 | 18 |
| 41 - 50 | 15 |
| 51 - 60 | 10 |

In the above example the insurance value would be 100000 * 18 = 1800000 lacs ($45000). If the age is say 52 yrs with an annual income 4 lacs ($10,000) the insurance value would be 400000 * 10 = 4000000 ($100,000).

## 2.8 PRODUCTION OF HEALTH CARE – THEORIES AND EMPIRICAL STUDIES

Drucker writes that the emerging theory of manufacturing includes four principles and practices: statistical quality control, manufacturing accounting, modular organization, and systems approach. SQC is a rigorous, scientific method of identifying variation in the quality and productivity of a given production process, with an emphasis on improvement.

The new manufacturing economics intends to integrate the production strategy with the business strategy in order to account for the biggest portions of costs that the old methods did not assess: time and automation. Production operations that are both standardized and flexible will allow the organization to keep up with changes in design, technology, and the market. The return on innovation in this environment is predicated on a modular arrangement of flexible steps in the process. Finally, the systems approach sees the entire process as being integrated in converting goods or services into economic satisfaction.

Laffel and Berwick are leading the conversion of health care from the disjointed, inspection-oriented improvement system into statistical quality control (SQC).[2] The old system's goal of conformance to standards assumes that some rate of poor outcomes is acceptable. There is, therefore, little emphasis on analyzing cases that meet the standard; rather, improvement occurs as a result of analyzing cases that go wrong. Also, the focus is on individual physicians and not the process problems that significantly contribute to substandard quality. SQC theory, on the other hand, has demonstrated that substantial quality improvement can be achieved by eliminating unnecessary variation in the execution of processes through which treatment plans are carried out.

Concurrent measurement of key process or outcome indicators is critical to the statistical control of the various processes put into place. The inherent variation in health care is of two varieties: "common cause" and "special or assignable cause." Common causes of variation are present (designed in) when the system is in "control," i.e., exhibits a binomial or normal distribution. When a system exhibiting predictable variability is acted upon by an event that "comes and goes capriciously," it is no longer predictable and is exhibiting nonsystematic variation as a result of this special cause. The effort of SQC, then, is to discover and eliminate these special causes, at the same time improving the predictability and outcome from the process by reducing the common causes variation.[3]

The common cause variation in health care, broadly called the standard of care, is noticeably broad for most conditions. We accept, for example, a two-fold difference in the incidence of prostatic surgery in two neighboring counties in Vermont, a one-and-one-half-fold difference in caesarian section rates between two hospitals or even two physicians, and a two- to three-fold difference in mortality rates among cardiac surgeons.

Special cause variation is fundamentally different and is not predictable within the system; it is an event that lies well outside the expected range of variation in the system. Berwick calls it the unintended variability in the system. Examples might be where one finds a defibrillator without battery power when using it, selects the wrong tube to draw blood, or misreads the label on a drug dose.

**Analysis of Hospital Costs**

Consumers Union notes that "Our health care system is so inherently wasteful and inefficient that a complete overhaul is an option worth contemplating." The waste is

principally inefficiency. Efforts to reduce administrative costs, schedule operating rooms more efficiently, streamline cafeterias, and root out obvious inefficiency are important, but, until volume and intensity of services are controlled, the expansive growth in costs will hardly slow.

Hospital costs have undergone very little research that explicitly associates costs with the quality of care delivered. It is one thing to evaluate total costs and another to relate them to a given level of quality. Traditional cost accounting can certainly compare total provider salaries and benefits, other salaries, supplies, drugs, interest, and fees among hospitals, but these costs are not typically related to quality. The principal driver of costs in care delivery is the intensity of services provided, which raises the obvious question of the value of the intensity to patient outcome: which level of intensity is most appropriate? A recent study explored this relationship by globally comparing costs among 300 hospitals and relating those costs to mortality rates. Predicted mortality rates were determined and the hospitals' total costs, adjusted for case severity, were matched to peer-group outcomes (mortalities among similar hospitals with similar case mixes).

A marginal cost for a "death deferred was derived and regression analysis related costs to this deferred death. A 1 percent increase in the level of quality (reduction in predicted death) was estimated to increase costs by 1.34 percent. There are clearly decreasing returns to scale, and, in larger hospitals (with more complex cases), marginal costs approached $140,000 per death deferred.

Using the Drucker concept of the new manufacturing accounting, health care financing must begin to address variations in service intensity as a specific cost deescalator. Moreover, the cost value of underutilized facilities (empty beds, unused technology) must be accounted for.

**Clinical Systems Design**

Drucker indicates that integrating the manufacturing process is the critical effort in converting goods (or services) into economic satisfaction. The delivery of health care lends itself very well to this integrated model. Restructuring of the hospital to optimize integration means breaking down old departmental lines and organizing work around the flow of patient care and treatment, not individual department tasks.

Production lines exist in hospitals, but they are now along discipline lines, such as admissions, radiology, or food services. Product lines in the future will be integrated along specific diagnoses or groups of diagnoses and will be organized around the needs of patients. The patient should experience little or no waiting time, reduced time in processes, little movement between stations, and contact with a limited number of employees. The patient should become a partner, rather than an object passed around the hospital at the convenience of the staff

**Medical Manufacturing**

Although Drucker addressed manufacturing, it is apparent that the health care system can be restructured in line with all four of his principles:

* Performance measurements according to standards must be established to effectively reduce common cause variation using methods of statistical quality control
* Cost analysis of systems must attend to the relationship of costs and quality and the cost-benefit of standardized care.
* Practice guidelines must define minimum standards of quality in terms of patient preference and outcomes in a flexible fashion.
* The entire episode of care must follow carefully designed, systematized processes that emphasize teamwork and integration along horizontal, patient-focused paths.

**Development of Guidelines**

The guideline is part of the medical record and, in tabular form, outlines appropriate indications for treatment or surgery, its timing and intensity, expected outcomes and criteria to measure outcomes, and a method to track variations. A variation occurs when the patient does not follow the expected pathway. It must be attributed to a key factor: the individuality of the patient, the physician's actions or orders, or other caregiver staff members and their actions or omissions.

## 2.9 INEQUALITIES IN HEALTH AND INSTITUTIONAL ISSUES

Health disparities (also called healthcare inequality in some countries) refer to gaps in the quality of health and health care across racial, ethnic, sexual orientation and socioeconomic groups. The Health Resources and Services Administration define health

disparities as "population-specific differences in the presence of disease, health outcomes, or access to health care."

In the United States, health disparities are well documented in minority populations such as African Americans, Native Americans, Asian Americans, and Latinos. When compared to whites, these minority groups have higher incidence of chronic diseases, higher mortality, and poorer health outcomes. Among the disease-specific examples of racial and ethnic disparities in the United States is the cancer incidence rate among African Americans, which is 10% higher than among whites. In addition, adult African Americans and Latinos have approximately twice the risk as whites of developing diabetes. Minorities also have higher rates of cardiovascular disease, HIV/AIDS, and infant mortality than whites.

## Ethnic and racial disparities

There is debate about what causes health disparities between ethnic and racial groups. However, it is generally accepted that disparities can result from three main areas:

- From the personal, socioeconomic, and environmental characteristics of different ethnic and racial groups (such as how certain racial groups, on average, live in poorer areas with high incidence of lead-based paint, which can harm children). A great deal of research on social determinants of health and the socio-ecological model have also surfaced, which connect economic and social conditions in determining a community's or a population's health.
- From the barriers certain racial and ethnic groups encounter when trying to enter into the health care delivery system; and
- From the quality of health care different ethnic and racial groups receive.

Each of these dimensions have been suggested as possible causes for disparities between racial and ethnic groups. However, most attention on the issue has been given to the health outcomes that result from differences in access to medical care among groups, and the quality of care different groups receive. Additionally, attention on health care disparities is largely focused on race and ethnicity; data on racial and ethnic disparities are relatively widely available. In contrast, data on socioeconomic health care disparities are collected less often, often using education as the indicator of socioeconomic status.

The goal of eliminating disparities in health care in the United States remains elusive. Even as quality improves on specific measures, disparities often persist. Addressing these disparities must begin with the fundamental step of bringing the nature of the disparities and the groups at risk for those disparities to light by collecting health care quality information stratified by race, ethnicity and language data. Then attention can be focused on where interventions might be best applied, and on planning and evaluating those efforts to inform the development of policy and the application of resources. A lack of standardization of categories for race, ethnicity, and language data has been suggested as one obstacle to achieving more widespread collection and utilization of these data.

The Institute of Medicine report, *Race, Ethnicity, and Language Data* identifies current models for collecting and coding race, ethnicity, and language data; ascertains the challenges involved in obtaining these data in health care settings; and makes recommendations for improvement.

A study of 20,000 cancer patients in the United States found that African Americans are less likely than European Americans to survive breast, prostate and ovarian cancer even when given equal care, but that other forms of cancer had equal survival chances, which suggests that biological factors may be at work.

## LGBT minority group health disparities

Often under emphasized are the minority groups that are heavily affected by health disparities in America, UK and all the same worldwide. Health disparities are not just based on race, ethnic, and cultural differences. Such disparities are seen as affecting the sexuality minority groups and observations and surveys show that one's sexual minority status may limit access to health care, with especially bad impact on lesbains, which are being discriminated both as females and as homosexual .

"Health inequalities exist for lesbian and bisexual women, largely related to experiences of discrimination, homophobia and heterosexism." This known interference with health care access is a prime example of heterosexual privilege and homosexual prejudice prevalence in Western societies. Just as this lack of health care affects minority races, ethnic groups, and less represented cultural beliefs; lesbian and bisexual women

are deteriorating their health by either not seeing (being feared of) or not be attended to by health care professionals.

It is important that health care professionals consider the nine cultural competency techniques suggested by the Agency for Healthcare Research and Quality and make an effort to break the barriers put into place through society's homophobia and heterosexism.

## Disparities in access to health care

Reasons for disparities in access to health care are many, but can include the following:

- **Lack of insurance coverage.** Without health insurance, patients are more likely to postpone medical care, more likely to go without needed medical care, and more likely to go without prescription medicines. Minority groups in the United States lack insurance coverage at higher rates than whites.
- **Lack of a regular source of care.** Without access to a regular source of care, patients have greater difficulty obtaining care, fewer doctor visits, and more difficulty obtaining prescription drugs. Compared to whites, minority groups in the United States are less likely to have a doctor they go to on a regular basis and are more likely to use emergency rooms and clinics as their regular source of care.
- **Lack of financial resources.** Although the lack of financial resources is a barrier to health care access for many Americans, the impact on access appears to be greater for minority populations.
- **Legal barriers.** Access to medical care by low-income immigrant minorities can be hindered by legal barriers to public insurance programs. For example, in the United States federal law bars states from providing Medicaid coverage to immigrants who have been in the country fewer than five years.
- **Structural barriers.** These barriers include poor transportation, an inability to schedule appointments quickly or during convenient hours, and excessive time spent in the waiting room, all of which affect a person's ability and willingness to obtain needed care.
- **The health care financing system.** The Institute of Medicine in the United States says fragmentation of the U.S. health care delivery and financing system is a

barrier to accessing care. Racial and ethnic minorities are more likely to be enrolled in health insurance plans which place limits on covered services and offer a limited number of health care providers.

- **Scarcity of providers.** In inner cities, rural areas, and communities with high concentrations of minority populations, access to medical care can be limited due to the scarcity of primary care practitioners, specialists, and diagnostic facilities.
- **Linguistic barriers.** Language differences restrict access to medical care for minorities in the United States who are not English-proficient.
- **Health literacy.** This is where patients have problems obtaining, processing, and understanding basic health information. For example, patients with a poor understanding of good health may not know when it is necessary to seek care for certain symptoms. While problems with health literacy are not limited to minority groups, the problem can be more pronounced in these groups than in whites due to socioeconomic and educational factors.
- **Lack of diversity in the health care workforce.** A major reason for disparities in access to care are the cultural differences between predominantly white health care providers and minority patients. Only 4% of physicians in the United States are African American, and Hispanics represent just 5%, even though these percentages are much less than their groups' proportion of the United States population.
- **Age.** Age can also be a factor in health disparities for a number of reasons. As many older Americans exist on fixed incomes which may make paying for health care expenses difficult? Additionally, they may face other barriers such as impaired mobility or lack of transportation which make accessing health care services challenging for them physically. Also, they may not have the opportunity to access health information via the internet as less than 15% of Americans over the age of 65 have access to the internet. This could put older individuals at a disadvantage in terms of accessing valuable information about their health and how to protect it.

**Institutional Racism in the US Health Care System Statement to the Committee on the Elimination of Racial Discrimination**

The present health crisis for racial minorities in the United States is part of a long continuum dating back over 400 years. After hundred of years of active discrimination, efforts were made to admit minorities into the "mainstream" health system but these efforts were flawed. Since 1975 minority health status has steadily eroded and there have been no significant improvements in the removal of barriers that are due to institutional racism.

**Health Status and Institutional Racism:** Minorities are sicker than White Americans; they have more illness and are dying at a significantly higher rate. Because of institutional racism, minorities have less education and fewer educational opportunities. Minorities are disproportionately homeless and have significantly poorer housing options. Racial residential segregation contributes to the concentration of poverty in minority communities. Communities with a high proportion of minorities are more likely than predominantly white communities to be exposed to environmental toxins, including lead and asbestos. Minorities disproportionately work in jobs with higher physical and psycho-social health risks (i.e., migrant farm workers, fast food workers, garment industry workers). Minority communities are frequently the targets of institutions promoting unhealthy products, such as alcohol and tobacco. Thus, the current health status disparity of minorities is the cumulative result of both past and current racism throughout the American culture.

**Manifestation of Institutional Racism in Health Care:** Institutional racism in health care has significantly affected not only access to health care, but also the quality of health care received. Institutional racial discrimination in health care delivery, financing, and research continues to exist. In 1999, the U.S. Commission on Civil Rights reported to the President and the Congress that: "*[The Government's] failure to recognize and eliminate [racial] differences in health care delivery, financing, and research presents a discriminatory barrier that creates and perpetuates differences in health status.*" Racial discrimination in health care manifests itself in many different ways including:

**Barriers to Hospitals and Health Care Institutions:** The institutional racism that exists in hospitals and health care institutions manifests itself in a number of ways, including the disproportionate closure of hospitals that primarily serve the minority community.

**Barriers to Nursing Homes:** Minorities are disproportionately excluded from nursing homes because of Medicaid policies which result in less expenditure on minority populations for nursing home care.

**Barriers to Physicians and Other Providers:** Minority physicians are significantly more likely to practice in minority communities. Yet, minorities are seriously under represented in health care professions and the minuscule efforts to solve that problem (affirmative action) are under serious political and legal attack.

**Lack of Economic Access to Health Care:** A disproportionate number of racial minorities have no insurance, are unemployed, and are employed in jobs that do not provide health care insurance, disqualify for government assistance programs, or fail to participate because of administrative barriers.

**Racial Disparities in Medical Treatment:** There is overwhelming evidence of racial and ethnic disparities across a wide range of in clinical care in the U.S. Studies document that the most favored patient is "White, male between the ages of 25 and 44".

**Disparate Impact of the Intersection of Race and Gender:** The unique experiences of minority women have been largely ignored by the health care system. Race discrimination and sex discrimination intersect to magnify the difficulties minority women face in gaining equal access to quality health care.

**Lack of data and standardized collection methods:** The existing data collection does not allow for regular collection of race data on provider and institutional behavior. The lack of a uniform data collection method makes obtaining an accurate and specific description of race discrimination in the health care system extremely difficult.

**Lack of Language and Culturally Competent Care:** The failure to use bilingual, professionally and culturally competent, and ethnically matched staff in patient/client contact positions has resulted in lack of access, miscommunication and mistreatment for minorities with limited proficiency in English.

**Rationing Through Managed Care:** The health care financing system has been steadily moving to managed care as a means of rationing health care. There is inadequate oversight to assure that managed care develops more expensive but culturally appropriate treatment modalities, to assure that they do not refuse or minimize the expenditures

necessary to develop adequate infrastructure for minority communities, or to assure that the rationing does not result in disproportionately affecting minorities.

**Institutional Racism and the Law:** Racial inequality in health care persists in the United States because the laws prohibiting racial discrimination are inadequate for addressing issues of institutional racial discrimination. The US legal system has been particularly reluctant to address issues of racial discrimination that result from policies and practices that have a disparate racial impact. In fact, the federal law explicitly allows for such discrimination as long as the institution can demonstrate "business necessity".

In addition, the legal system requires individuals to be aware that the provider or institution has discriminated against them and that they have been injured by the provider, two conditions that are highly unlikely in racial discrimination in health care. Finally, the health care system, through managed care, has actually built in incentives which may encourage discrimination. Unlike housing, education, lending and employment, the federal government has not taken any action to address these unique civil rights enforcement problems in health care. State and federal law has proven ineffective in reducing and eliminating racial discrimination in health care and the US government has taken little action to correct the problem. In 1999, the U.S. Commission on Civil Rights reported that "[the government's] failure to address . . . deeper, systemic problems is part of a larger deficiency - a seeming inability to assert its authority within the health care system."

**Activity 2**

1. What in your view are different determinants of health? Discuss how poverty affects the health of an individual.
2. Explain the concept of health care financing.
3. What do you understand by human life value? Discuss with suitable example.
4. Write short notes on the following"
   - Production of health care
   - Health disparities
   - Demand and supply in health care

## 2.10 SUMMARY

Health makes an important contribution to economic progress, as healthy populations live longer, are more productive, and save more. The unit reveals first the contribution of health in development of the economy along with the economic dimensions of health care. It further deals with various determinants of health as social belongings, stress, poverty, unemployment, transport, food, addiction, work and early life of and individual. The next area of concern was the demand and supply of health care around the world. Unit further discusses the financing of health care along with various policy issues and resources. Human life value has been discussed using suitable examples and various theories and empirical studies on production of health care are explained in detail. Finally health care disparities also called health care inequalities are revealed with institutional issues of health care delivery.

## 2.11 FURTHER READINGS


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