AEC 301

NATURAL RESOURCE MANAGEMENT AND AGRICULTURAL DEVELOPMENT

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Chapter 1

NATURAL RESOURCES : CONCEPTS, CLASSIFICATION AND ISSUES

Definition and classification

Natural resources in an economy are the crucial resources, which should be treated in a holistic manner so as to achieve many benefits. The objectives of natural resources management should be to bring about economically productive, socially equitable and environmentally sustainable uses of these resources. *Natural resources could refer to all the living and nonliving endowment of the earth, but traditional usage confines the term to naturally occurring resources and systems that are useful to humans or could be under plausible technological, economic, and social circumstances*. The major classes of natural resources are agricultural land; forest land and its multiple products and services; natural land areas preserved for aesthetic, recreational or scientific purposes; the fresh and salt water fisheries; mineral resources that include the mineral fuels and non-fuels; the renewable non-mineral energy sources of solar, tidal, wind, and geothermal systems; water resources; and the waste-assimilative capacities of all parts of the environment (Howe, 1979). It is lucid from the definitions that what we perceive as natural resources depend on the conditions we have inherited from the past, present or foreseen technologies, economic conditions and tastes.

More generally, natural resources fall into four categories: (I) basic natural resources such as land, water and air, (ii) natural resource commodities such as timber and fish, (iii) environmental amenities such as clean air and scenic views and (iv) environmental processes such as pollution, soil erosion, ground water recharge, and species regeneration.

Natural resource supplies must be thought of both in terms of the stocks or inventories that are thought to exist at the moment (reserves) and the flow of useful natural resource commodities or services being produced from those stocks. The stocks or reserves indicate what is known to be available for use over future time, while the flow of commodities or services is indicative of current utility being realized. Some natural resource stocks are renewable by natural or human assisted processes while others are non-renewable. Solar, wind, and tidal energy and farmland, forests, fisheries, air, and surface water exemplify the renewable resources, while the mineral ores and fossil fuels exemplify the non-renewable resources. Renewability often depends on appropriate non-destructive methods of management, as with farmlands, fisheries, and waste disposal, since some changes in natural resource systems are irreversible.

What is understood as the relevant stock of a resource depends on available technology, costs, and social constraints. Aluminium contained in ores other than bauxite is not a useful resource until the needed recovery technology is developed. The production of many minerals from seawater is feasible but is currently ruled out by high costs in most cases.

In the assessment of natural resource stocks, it is important that interactions with other systems and potentially irreversible changes be taken into account. When coal is strip minded, flows of groundwater may be interrupted and streams and wells may permanently go dry. Acid from sulphur exposed to rain and air may foul water supplies and kill plants and fish. Thus natural resources must be looked on as parts of larger systems.

Table.1.1 Classification of Natural Resources

Particulars	Stock	Flow
Non-renewable	Coal, oil, iron, copper, other metals, old growth timber, soils	Wind, flowing river water
Renewable	Water stored in tanks, solar energy stored in cells	Young growth timber, annual crops

Source: John M.Kerr et.al., (1997)

Uses of natural resources

Natural resource uses include *direct consumption* such as fresh fish, water, outdoor recreation, and firewood; *inputs* into intermediate processing such as iron or copper ores into smelting; *consumptive uses* in intermediate processing such as fuels consumed in manufacturing and transport; and *in situ* uses like free-running rivers, parks, and wilderness areas. In some cases, these modes of utilization can be combined into multiple-purpose natural resource systems that utilize resources simultaneously to satisfy several needs. For example, the management of forest lands to produce timber, to act as a watershed and to provide recreation.

Natural Resource Issues

The major question posed by the world's natural resource situation unquestionably is "*How long and under what conditions can human life continue on earth with finite stocks of in situ resources, renewable but destructible resource population, and limited environmental systems*?". Some facts seem clear that some currently vital resource stocks (such as mineral fuels) are finite; that rates of consumption of these stocks have accelerated in recent decades far beyond all historical rates; that some major renewable resource systems (e.g., marine fisheries, and some groundwater systems) are being destroyed; and that environmental capacities are being seriously exceeded. Thus it is not surprising that people should be concerned.

A second major issue is the *location of known reserves*. World petroleum reserves are huge and more is being discovered each year but those reserves are not located in the major consuming countries of the West. The same is true of bauxite, iron ore, chromium, and natural gas. What does this imply for the vulnerability of consuming countries to political pressures and exorbitant price increases by groups of supplying countries?

A third issue is the *historical shift away from renewable resources toward dependence on non-renewable resources*. For example, coal became important when charcoal supplies became increasingly costly, both in terms of proximity of forests and in terms of undesirable environmental effects. In most parts of the world, agriculture has shifted from natural fertilizers to those synthesized from natural gas. Consumer durables and commercial packaging shifted from patterns of reuse and repair to throwaway strategies. As non-renewable natural resource stocks dwindle, can these patterns be reversed? Should they be reversed?

A fourth issue is the *contemporary evolution of the wisdom of past patterns of resource utilization*. There are examples of unwise, short sighted, rapacious exploitation of natural resource systems along with their related social systems.

A fifth issue closely related to the foregoing is whether or not we have correctly understood the *role and importance of natural resource and environmental service as*

factors in our past economic growth. Most analyses of the causes of economic growth have placed great emphasis on the growth of technology and improvement of human capital, but few have adequately examined the role of raw material inputs and the increasing use of the environment for waste disposal. It appears possible that these inputs may have been more important than suspected and may not be freely available in the future.

A sixth issue is the *growing dependence on increasingly inferior reserves of natural resources*. In the cases of many resource stocks, one finds a continuous spectrum of quality and quantity, implying greater reserves at the cost of exploiting poorer ores. Seawater contains incredible stores of minerals, but the energy requirements for recovery are, in most cases, prohibitive. Will energy availability permit the exploitation of these resources or must we forget them as usable reserves? And then, what of the environmental consequences of exploiting such resources. How is it possible to continue exploiting more diffuse resources without defiling our environment? Is it possible to avoid major changes in ecosystems as we push back the margins of agricultural land use, forest harvesting, fishing, and water development?

A seventh issue closely related to the previous two is the *evolution of limiting global environmental conditions*. The most widely discussed is the build-up of carbon dioxide in the upper atmosphere, largely as a result of fossil fuel combustion and deforestation. This may have major effects on the earth' s temperature and climate. If science determines that it does, severe limits may be placed on economic activities.

An eighth issue is the *role to be given to market processes in determining how resources will be managed over time*. Markets play an important role in determining exploration activity and rates of use. It has been convincingly demonstrated that changing relative prices has largely induced technological innovation.

Reserves, Rates of Use and Exploration

The term reserves refer to indicate definite quantities and qualities of resources known to exist. Yet, reserve data seem to change frequently and appear to be subject to great uncertainty. Why should there be so much uncertainty regarding reserves?

The first and simplest reason is the non-standard use of terms such as resources base, and reserves. A second reason is geological uncertainty: inventories by quantity, quality, and location are subject to margins of estimating error that differ by resource and location but that are often quite wide. A third reason that is often ignored is that the very concept of socially relevant reserves depends heavily on technological and economic circumstances. This dependence is most easily seen in terms of the relation between price and the reserves that could be exploited at that price.

While reserves are most frequently mentioned in connection with the non-renewable mineral resources, information on the stocks of the renewable resources is just as vital to their management. Stocks of resources are supplemented by the discoveries resulting from exploration. Renewable resources have their own growth or replenishment processes, but even for them exploration for existing stocks has been an important source of new supplies. The processes of exploration are intimately related to natural resources management.

Exploration produces information on resource stocks. Sometimes this information is precise with a high degree of certainty, but at other times the information is at best probabilistic in nature and subject to wide margins of error. If exploration were costless, it would be desirable to have all possible information on existing resource stocks.

However, exploration is costly and the information it yields must be treated commodities. It would not be sensible from an economic viewpoint to obtain complete information, even if this permitted savings in production costs and reduced uncertainties about our endowments of resources.

Scarcity of Resources

Economists would say that any commodity having a positive price in competitive markets is scarce. Fisher (1978) stated that an ideal index of scarcity should measure the direct and indirect sacrifices has been suggested: (1) the price of a natural resource commodity, (2) the rental or royalty payment made for land containing resources, (3) the costs of physical extraction (not including royalty payments), and (4) measures that indicate how easily capital and labour can be substituted for natural resource inputs.

Factors Mitigating Scarcity

How can it be that a rapidly developing nation that has experienced strong economic and population growth has not, to date, experienced greater increases in natural resource scarcity? Many factors have been at work, some of which are listed below.

1. Technological Changes

Those increasing the efficiency of resources use: greater smelting recovery of metals from ores and finer woodworking techniques to save wood.

Those increasing natural resource recovery both through leaving less in situ and by facilitating use of lower grades: tertiary petroleum recovery, long wall coal mining, pelletising of taconite iron ores.

Those that permit use of formerly unusable resources: aluminium from nonbauxite sources.

Those that permit new products to fulfil old functions: solid-state electronic for vacuum tube systems, communication conference networks for personal travel.

2. Substitution of More Plentiful Resources for Less Plentiful

Substitutions in production processes: aluminium for copper, prestressed concrete for structural steel, organic biocides for mercury compounds.

Substitutions in consumption: grains for meat, artificial fibres for natural fibres, plastics for leather.

3. Trade

General improvements in transport that make more remote resources economically competitive.

Utilization of international sources: bauxite from Jamaica, iron ore from Liberia.

4. Discovery

Extension of traditional exploration methods for discovery of new deposits.

Improvements in exploration techniques: geophysical and geochemical methods, satellite reconnaissance.

5. Recycling

Percentages of U.S. consumption derived from scrap: iron 37 percent; lead, 37 percent; copper, 20 percent; aluminium, 10 percent; nickle,35 percent; antimony 60 percent.

Common Property Resources (CPR)

Property rights

The term property may be defined as a benefit (or income) stream from any tangible or intangible objects and (or) circumstances and a property right as a claim to a benefit stream that is recognised and respected by people conventionally, legally or otherwise (Singh, 1997). In this sense, property is but a social relation involving income streams, property right holders and duty bearers. The term tenure is commonly used to mean the right to hold or possess something and the terms and conditions of holding. In that context, we sue tenure to mean the act or fact of holding natural resources and the terms and conditions governing the holding of resources and the relationship between the tenant and resource owner.

Property and property rights are integral to how our society functions. These rights are classified into four broad management systems, called property right regimes that allow us to expect certain kinds of behaviour from other members of our society. A property, or resource, regime is an institutional arrangement of rights and duties (either explicit or implicit) that establishes the relationship between individuals with respect to a specific resource. This means that a property regime defines a society's collective perceptions about the scarcity and value of resources protected by that regime.

In the context of natural resources, the notion of property rights involves a bundle of rights in the use and transfers of natural resources and importantly, the right and ability to exclude others from exercising their rights. Examples of such bundles of rights include the rights to consume, sell, exchange, lease, bequeath and preserve.

Depending up on the nature and structure of rights in a resource or property, we may classify property according to four broad categories: Private or exclusive property, State property, Common property and non-exclusive or nobody's property.

Public Lands With Open Access Property are open to all and no one owns the resource and over exploitation occurs and it is difficult to define property rules. Thus the individuals have both a privilege and no rights with respect to use and maintenance. Open access refers to the absence of control; and valuable assets are in the public domain.

Common Property Resource (CPR) Resources that are owned in common and managed for a common purpose. It is owned by an identified group of people which has the right to exclude non-members and the duty to maintain the property through constraints placed on use and reciprocal externalities are the hall mark of CPRs and the use of CPRs is subtractive, having the characteristic of a public good such as indivisibility

State Property (Government Property) People have the right to use the resources within the rules framed by public agency to promote social objectives.

Private Property The control of assets is by private individuals. The rights and ownerships are assigned with individuals for the socially acceptable uses.

Fundamental characteristics of CPRs

Distribution of property rights in resources in which a number of owners are co-equal in their rights to use the resource. This means that their rights are not lost through non-use.

Potential resource users who are not members of a group of co-equal owners are excluded. To put it more clearly, for common property to be truly common property implies its existence as an institution.

A CRP is defined as a property on which well-defined collective claims by an exclusive group are established; the use of the resource is subtractive, having the characteristics of a public good such as indivisibility.

Characteristics of CPRs

Exclusive rights on the use & well-defined group for the resource use.

Non-excludability condition- no member can be excluded from the use.

No single individual in the group has any exclusive property rights and use of resource is subtractive

Degree of indivisibility of the resource like a public good

A particular group of a community have exclusive rights on the use and access to resource without ownership rights

Exclusion of owners/ control of access to those resources from outside of the group is often problematic

A set of rules regarding the use and sharing of resources and benefits

An institution within the group to impose rules and regulations, outside of the legal institutions such as courts

CPR assumes the nature of open access resource of fugitive resource, whenever one or other characterised mentioned above are violated

Importance of CPRs

The share of Gauchar land to total geographical area in 25 villages of Gujarat reduced by 10.3 per cent in 30 years from 1961-62 - Iyengar (1989).

In India between 1950-52 to 1982-84 - CPLRs area has declined by 24 per cent - Jodha (1990).

CPR percemtage area reduced from 35.6 to 23.7 in 1989 -90 in 14 villages in Karnataka - Pasha (1992).

Assuming that 70 per cent of the lands under CPLR are degraded, 56 mha of CPLR are degraded, which is approximately 43 per cent of the total degraded area in India - Laxmi and Jyoti(1997).

Chapter 2

LAND RESOURCES

Land resources form the most important natural resource of the country and their proper utilisation is crucial to any economy. The utilisation of the land according to its use capability ensures that this resource is utilised yo the best advantage. Its improper use leads to wastage and can lead to progressive deterioration and loss of productivity of this vital resource. It is the moral obligation of the present generation to pass this valuable resource on to the future generation as nearly unimpaired and over-exploited as possible.

AGRICULTURAL HOLDINGS

The term *agricultural holdings* implies the total area of land which is held for cultivation as a single unit by an individual, joint family or more than one farmer on a joint basis. Such land may either be owned, taken on lease or may be partly owned and partly rented.

An *operational holding* is one that includes all lands (i.e. cultivated, fallow, and even which is not under cultivation) used wholly or partly for agricultural production operated as a single technical unit by a single household or a number of households operating jointly. An individual may have a single or a number of operational holdings if each of them constitutes a separate unit of management.

An *ownership holding* includes all the area owned by a cultivator or a number of cultivators jointly whether under own cultivation or subjected to others. The concept of this type of holding is useful under feudal system as it gives an idea whether land ownership is concentrated in a few hands or is evenly distributed. It may also be known if the tendency is towards further concentration of land or it is towards dispersal among a number of persons.

Size of holding

The size of an agricultural holding in any country depends on geographical and climatic conditions, partly upon the laws and social institutions, partly upon the methods and techniques of cultivation. The ideal size of the holding will vary with the nature of the crop, and the objective of agricultural production. Thus, the question of whether a holding is economic or uneconomic is a relative one. According to Keatingu, an economic holding is one which allows a man a chance of producing sufficient to support himself and his family in reasonable comfort after paying his necessary expenses.

According to Agrarian Reforms Committee, an *economic holding* is that (i) which must afford a reasonable standard of living to the cultivators, (ii) provide full employment to a family of normal size and at least to a pair of bullocks, and (iii) have a bearing on other relevant factors peculiar to the agrarian economy of the region. A *basic holding* is a holding smaller than the economic holding which may be able to provide a reasonable standard of living to the cultivator but not sufficient for the purpose of agricultural operations. The Committee suggested such a unit for individual cultivation with the assistance of the multi-purpose cooperative organization in all other aspects. An *optimum holding* is the holding which keeping in view the ceiling to the size, the managerial capacity and financial resources of an average cultivator, refers to the size not exceeding three times the size of an economic holding.

The idea of family holding was introduced by the Committee appointed by the Land Reforms Panel of the Planning Commission to report on the size of farms. The

Commission has defined family holding as an area equivalent, according to local conditions and under existing conditions of techniques, either to plough unit or to a work unit for a family of average size using a pair of bullocks.

Size Pattern of Holdings in India

Number of agricultural census has been made to study the size holding pattern in the country. The basic unit for study in this census has been the operational holding as distinct from the ownership holding. Here the technical unit was defined as that unit which is under the same management and has the same means of production, such as, labour force, machinery and animals. The objective of these agricultural censuses was to lay emphasis on actual cultivator and not the owner. The concept of operational holding was considered as the fundamental decision making unit in all the agricultural development programmes.

Table.2.1 Number of Operational holdings in India

(Millions)

Particulars	1971	1981	1991
Marginal holdings (< 1.0 hectares)	36 (51.00)	50 (56.18)	62 (58.00)
Small holdings (1.0 – 4.0 hectares)	24 (34.00)	28 (31.46)	34 (33.00)
Medium holdings (4.0 – 10.0 hectares)	8 (11.00)	8 (8.99)	8 (7.00)
Large holdings (10.0 Ha. And above)	3 (4.00)	2 (2.25)	2 (1.00)
Total	71 (100.00)	89 (100.00)	106 (100.00)

It could be seen from the Table.2.1 that the number of operational holding increased from 71 million in 1971 to 106 million in 1991 signifying an increase of 48 per cent, even though the area operated increased only marginally from 162 million hectares to 166 million hectares during this period. The marginal holdings has increased from 36 million to 62 million for period between 1971 and 1991 where as the area operated by them rose to 25 million hectares from 15 million hectares. The increase in area operated just compensated the increase in the number of holdings. This indicates that this group of marginal cultivators who have little land continued to live below the poverty line since average size of marginal holding of 0.40 hectare of land is too meagre to eke out a living. The small holdings has increased from 24 million to 34 million during 1971 to 1991 where as the medium holdings remain almost constant over the years. The large holdings have decreased from 3 million to 2 million for the same period.

During the past five decades of planned development, there are two school of thoughts on the trends in size of holding. One school of thought says that there has been growing division of agricultural holdings partly due to the growth of rural population and partly due to the operation of the law of inheritance among the Hindus under which both sons and daughters get equal share in the ancestral property. The second school of thought argues that, under ceiling of land holdings, large agricultural holdings have been divided-at least in those states where ceiling legislation has been properly implemented-and surplus lands have been distributed to small and marginal farmers.

Despite these two different schools of thoughts, Table.2 lucidly brings out the following.

- The number of marginal and smallholdings had increased from 60 million to 96 million between 1971 and 1991. That is the number of marginal and smallholdings had increased from 85 per cent to 92 per cent of all land holdings in the country.

- During the period of 1971 to 1991, medium and large holdings had declined in number (from 15 per cent to 8 per cent of the total number of holdings). Actually there is not much change in the number of medium holdings, which is about 8 millions in both the years, and there is also not much change in the area under medium holdings.

- The real change during this period is with regard to large holdings. The number of large holdings had declined from 3 million to 1.6 million and the area under large holdings has declined sharply from 50 million hectares to 29 million hectares during this period.

It is possible therefore to conclude that there is a gradual but positive shift in favour of small and marginal holdings and the concentration of land with very large landowners is coming down. This indeed is a welcome trend.

SUB-DIVISION AND FRAGMENTATION OF HOLDINGS

The problem of agricultural holdings in India is two-fold. Not only the average holdings are small but, they are also fragmented and are found not in one compact block but in tiny plots scattered all over the village. Each holding consists of many small pieces, which are found in different parts of the village.

Causes for sub-division and fragmentation of holdings

There are number factors responsible for subdivision and fragmentation of holdings, which occurred over a period of time.

Population pressure on land: As population increases the available supply of land per head of population decreases. Due to heavy pressure of population, the available limited land gets divided and subdivided among a large number of populations and as a result the size of holdings correspondingly goes on diminishing.

The Law of Inheritance and Succession: Burgeoning population by itself need not result in subdivision and fragmentation of holdings. This process of subdivision and fragmentation is helped by the operation of Laws of Succession and inheritance. According to the Hindu and Mohammedan laws of succession, all sons (and daughters) are equally entitled to a share in the ancestral property. As a result, even large agricultural estates get divided and subdivided with every generation. Thus, growing population coupled with the system of inheritance has been responsible for the small sized holdings in the country.

Change in family system: The joint family system, which was so common a few decaed ago, held together a number natural families. The lands were held in common and all agricultural operations were managed together. But under the impact of industrialisation and growth of urban the joint family has broken down and the emergence of nuclear family system. This has led to subdivision and fragmentation of holdings.

Inadequate alternate employment opportunities: This is the chief cause of subdivision and fragmentation of holdings because with decline of small-scale cottage industries in rural

areas, artisans had fall back upon land, as there were no opportunities for employment. This further increased subdivision and fragmentation of holdings.

Rural indebtedness and indigenous moneylenders: The village money lenders are highly unscrupulous and have only one interest in lending to the needy farmers, that is to grab the lands of the farmers. They encourage the farmers to borrow, charge them high rates of interest and adopt many unfair practices. As the only way of recovering usurious loans is to acquire agricultural land, ultimately plots of land pass from farmers to the moneylenders in lieu of debt payments. Advancing indebtedness, mortgages into possession, land speculation and even indiscriminate investment in land during the plan period has further aggravated the problem.

Land reform measures: The various land reform measures implemented by the government increased the pressure on land. The abolition of intermediary tenures and tenancy reforms has created a large number of owner cultivators. Ceiling on land holdings has also resulted in the acquisition of some surplus land for redistribution among landless labourers and owners of smallholdings. Besides, the delay in the implementation of the legislation has enabled big owners to dispose of their surplus land through malafide transfers in the shape of benami transactions.

Finally the process of subdivision and fragmentation of holdings may be further complicated by voluntary transfers by sale, ift etc.,

Problems of sub-division and fragmentation of holdings

The process of sub-division and fragmentation of holding occurred over a period of time has led to number of disadvantage. They are briefly discussed hereunder.

- The fragmented and uneconomic holdings have brought about progressive agricultural deterioration and aggravated the poverty of masses.

- The cultivation of an unduly small holding entails waste in a number of ways. This practice involves encroachment on the soil otherwise available for cultivation. It entails waste of land in boundaries, hedges and pathways.

- Sub-division progressively reduces the average size of holdings. When the holdings get smaller the proportion of fixed costs to the total costs of cultivation increases. Some of the cost incurred by the farmers such as expenses of maintaining livestock and few implements do not decrease proportionately when the size of land decreases.

- Sub-division also raises the variable costs of agricultural production. The cost of fencing per hectare, of manure and seeds, are all higher when the farmer cultivates a small piece of land other than a big holding, in which case fencing may not be done to the fields leading to damage by stray cattle from the neighbouring fallow fields.

- Act as a hurdle for adoption of modern improved technologies and farm mechanisation

- When holdings are intensely fragmented, much time is naturally lost in moving from one to plot to another, particularly at the time of sowing, harvesting and other key intercultural operations. This decreases the efficiency of farmers and other key resources.

- Fragmentation creates difficulties in maintaining correct levels and making provision for surface drainage. When a landowner holds his land in scattered bits he has naturally less incentive to spend money on the maintenance of proper drains to prevent waterlogging and on the construction of embankments to check soil erosion.

- When land is excessively fragmented, irrigation often becomes impracticable, although sufficient water may be available.

- Fragmentation also brings in its train the invariable crop of disputes regarding boundaries, rights of way, leading the farmers into expensive litigation and social conflicts.

Thus, small and scattered farms are clearly an impediment for the efficient organization agricultural production in the country.

Remedies for Sub-division and fragmentation of holdings

The process of sub-division and fragmentation of holding could be stopped by adopting measures such as consolidation of holdings, creation of economic holdings, co-operative farming and restriction on further sub-division and fragmentation of holdings.

Consolidation of holdings: It has been felt that the proper solution for the problem of sub-division and fragmentation of holdings is consolidation of holdings. By consolidation we mean the bringing together in one compact block all plots of land of a farmer which are scattered all over the village. Consolidation is achieved by first pooling all land in the village into one compact block and then dividing it into compact blocks among all the farmers in the village.

There are some important difficulties when consolidation is done.

- The farmers are extremely better attached to their ancestral land and therefore, are unwilling to give it up for the sake of consolidation of holdings.

- Those having better quality lands do not like to combine for fear that they may get inferior blocks after consolidation,

- Consolidation is a cumbersome process. The government officials who implement the scheme are generally slow and often corrupt, and

- In general the movement has not evoked the necessary cooperation from the poorer sections of the peasantry.

Creation of economic holdings: One of the important aspects of land reforms in India is the increase in the size of holdings and the consolidation of scattered holdings. Creation of economic holding could be achieved by following means:

- The fixation of ceiling on holdings, so that all those who have more than the prescribed maximum limit in a village will have to surrender their surplus land to the public authorities who will then distribute the same among those who have uneconomic holdings.

- Those farmers who have extremely small holdings may be induced to give up their lands and shift to other occupations in rural areas,

- The pressure on land may be reduced by the starting of industries in rural areas to provide employment to the landless labourers and marginal peasants.

Co-operative farming: Consolidation of holdings does not promise to give the cultivator an economic holding. If the cultivator has a small area of land scattered in different parts of the village consolidation will bring the land together but it cannot possibly increase the size. In order, therefore, to provide economic holding for each cultivator a much bigger effort is required and that may be co-operative farming. Thus, what is ultimately visualised is an integrated socio-economic rural structure in which agricultural production, village industries, processing industries, marketing and rural trade are all organised on co-operative lines.

Restriction on further sub-division and fragmentation of holdings:

Restrictions are necessary on future partitions, exchanges or transfers. Sub-division and fragmentation of land holdings could be prevented by: (i) change in the Laws of Inheritance whereby the land passes only to the eldest son and (ii) sub-dividing land only up to a certain stage beyond which further subdivision should be prohibited.

Chapter 3

LAND REFORMS

In countries like India, which are thickly populated and relatively underdeveloped, the land man ratio is already acute and the pressure of population on land is very much. It will be very much difficult to bring more area under cultivation. Provision of irrigation facilities to more areas and conversion of single cropped areas to double cropping will be possible to a limited extent. Land is the primary resource on which agriculture is based. The pattern of ownerships of this asset has to be just and rational if we are to secure growth with social justice.

Among the various factors that affect production and productivity in agriculture, the institutional reforms, land reforms in a country are essential in order to achieve increased productivity. These institutional reforms include the redistribution of land ownership in favour of the cultivating classes so as to provide them a sense of participation in rural life, improving the size of farms, providing security of tenure, regulation of rent etc., In other words, the institutional factors such as the existence of small size of holdings, subdivision and fragmentation, insecurity of tenancy rights, high rents etc., act as disincentives to the peasantry to raise productivity and production. These factors weaken the capacity of the farmers to save and invest in agriculture. Consequently, two school of thoughts emerged. One school of thought argues that the institutional factors can only increase productivity. The second believes that agricultural productivity is purely a technological phenomenon and that it can be raised by adoption of modern technologies. It can be said that technological change can work well with a well-defined agrarian structure and thereby the process of development could be accelerated.

The term land reform as it is generally understood means the redistribution of property in hand for the benefit of small farmers and agricultural workers (Jhingan, 1991). More specifically the objectives of land reform measures are (I) to increase agricultural production by improving the economic condition of the small farmers and tenants by consolidation of holdings and tenancy reforms, (ii) by abolishing intermediaries, providing security of tenures and distribution of surplus land and (iii) the increase in the productive efficiency and income of the rural people will tend to create more demand for consumer goods and agricultural inputs and thereby diversifying the economy. The first Five Year Plan of India laid down two objectives of land reforms, which have been carried through in the other five-year plans. The objectives of the land reform policy over the successive plans have been to remove impediments to agricultural development which arise from the agrarian structure inherited from the past and to eliminate exploitation and social injustice within the agrarian system so as to ensure equality of tenurial status and opportunity to all.

Land Reform Measures

The main elements of the land reform policy have been five-fold:

- Abolition of intermediaries
- Tenancy reforms comprising regulation of rent, security of tenure and conferment of ownership rights on tenants
- Ceiling on land holdings and distribution of surplus land
- Consolidation of holdings, and
- Reorganisation of agriculture

Abolition of Intermediaries

At the time of independence, the usual systems of land tenure in India were the Zamindari, the Ryotwari and the Mahalwari. Under the Zamindari system, which was introduced by Lord Cornwallin in 1793 in Bengal, one person held land or at the most by a few joint owners who were responsible for the payment of land revenue. Mahalwari tenure, the village communities held the village lands jointly, the members of which were jointly and severally responsible for the payment of land revenue. Under Ryotwari tenure, land may be held in single independent holdings. The individual holders were directly responsible to the state for the payment of land revenues. In these systems, landlords, jagirdars, talukdars, inams etc., were the various forms of intermediaries who collected rent from the cultivators and deposited it with the state in the form of land revenues.

During 1954 all the States passed laws to abolish intermediaries. As a result, about 20 million tenants have come into direct contact with the State. About 58 lakh hectares have been distributed among tenants and sharecroppers. Besides, large areas of forestland, grazing land and cultivable wastelands belonging to intermediaries have been vested in the State. Intermediaries have been permitted to retain farmlands for personal cultivation within certain limits. The limits of farm differ from state to state depending upon their agro-climatic conditions. Intermediaries have been paid compensation for the loss of their rights. The total compensation to intermediaries has been estimated at Rs.670 crores, out of which Rs.320 crores had been paid partly in cash and partly in bonds spread over a period of 20 to 40 years by the end of 1970.

The abolition of intermediaries brought tenants into direct relationship with the State and conferred full ownership rights on the others, thereby, putting an end to exploitation by landlords. It also increased the income from land revenue to the State governments. Thus it has been beneficial both socially and economically. On the other hand, the State was burdened with the payment of large compensation. Many intermediaries evicted the tenants and while others retained considerable portions of land dividing it among their family members. Some of the Zamindars continued to retain their entire holdings of land by forming co-operative farming societies on paper among their tenants, while others formed religious and charitable trusts to evade the law.

Tenancy Reforms

Tenancy reforms comprise regulation of rent, security of tenure and conferment of ownership rights on tenants. The first Five Year Plan laid down three guidelines for the tenancy reforms. They are (I) Rent should not exceed 1/5 or1/4 of the gross produce, (ii) All tenancies should be declared non-resumable and permanent except in certain specified circumstances and (iii) in respect of non-resumable land, the land-lord tenant relationship should be ended by conferring ownership rights on tenants.

Regulation of rent Before the enactment of laws, tenants were paying rents as high as 50 - 80 per cent of the produce to the landlords. The maximum rate of rent have been fixed at levels not exceeding 1/4 or 1/5 of the gross produce In all states except in Andhra Pradesh, Punjab and Haryana. In Andhra Pradesh, it is 30 per cent for irrigated land and 25 per cent for dry land, while in Haryana and Punjab it is 331/3 per cent of the gross produce.

Security of Tenure The legislation for security of tenure have been passed in several states with a view to (I) prevention of large scale ejectments of tenants, resumption of land by the owner for personal cultivation only and assuring a prescribed minimum area of land to the tenant in the event of resumption. Except Uttar Pradesh and Delhi, in no other states, tenants have been provided complete security. In some states in the event of resumption of land for self-cultivation by the landlord, or minimum land is required to be left with the tenant cultivator. In others, there is no provision for a minimum land to be left

for the tenant in case of resumption of land for self-cultivation. The legislation lays down the conditions under which the tenants are liable to ejection. These include non-payment of rent, sub-letting the land, and using the land for non-agricultural purposes. The states Acts also provide for the right of resumption of land by the owner if the same is a small owner, widow, minor, unmarried women, physically handicapped. Thus, under the existing legislation, the position of tenants continues to be insecure in Bihar, Tamil Nadu, Andhra Pradesh, Punjab and Haryana.

Ceiling on Land holdings Ceiling on agricultural land holdings means fixing the maximum up to which a cultivator can hold land. The aim is to reduce the concentration of land holdings in few hands and to provide economic holdings to the landless agricultural workers and marginal farmers in order to increase employment and income opportunities. Laws imposing ceiling on agricultural holdings began to be implemented during the Third Five Year Plans. Prior to 1972, the unit of application was an individual landholder so that every member of a family could hold land up to a prescribed limit. This posed a large number of problems. For example, in Punjab and Haryana, an individual landholder could hold 27 to 100 acres and in Andhra Pradesh 27-234 acres. Consequently, the results achieve were meagre due to high ceiling level, large number of exemption, and poor implementation. Accordingly only 23 lakh acres of land was declared surplus after the imposition of ceiling in the different states out of which 12.5 lakh acres had been distributed to landless and marginal farmers till 1972.

After 1973, the law has been slightly changed, a family consisting of 5 members has been made the unit of application, the maximum ceiling limit has been lowered, the range between the lowest and the highest has been narrowed and most of the exemption has been withdrawn. For example, in Tamil Nadu, irrigated with two crops the ceiling is 4.80 hectares, 12.14 ha for irrigated with one crop and 24.28 ha in dry lands. But the progress of taking over the distribution of ceiling surplus land has been very slow. Of nearly, 7.3 million acres of land, 5.3 million acres have been taken possession in various states. Of this, nearly, 4.5 million acres have been distributed among more than 4.2 million peasants. A scheme of providing financial assistance to assignee of ceiling surplus land was started in 1975-76 for the landless poor so as to enable them to cultivate assigned land that is generally of poor quality. Under this scheme, financial assistance is provided upto Rs.2500 per hectare in the form of grant to the assignee for simple land development, provision of inputs and for immediate consumption needs. A total of Rs.25 crores have been released since its inception and Rs.30 crores were provided in sixth plan but the centre did not release the amount. Thus little progress has been made in this distribution.

Consolidation of holdings It implies that rearrangement of scattered and subdivided holdings of individual farmers by exchanging them with similar holdings of other farms in a particular area. The average size of holding is not only small but also scattered and the average size is declining over the years. This is indicative of the continuous pressure being exerted on land resources by a steadily growing population. This has further led to subdivision and fragmentation of the agricultural holdings. Fifteen states have passed laws to undertake consolidation of holdings. But their implementation has been extremely sporadic. It is successful only in Punjab, Haryana and Western Uttar Pradesh. By the end of 1988, about 58 million ha of land had been consolidated all over the country. Lack of maintenance of land records, finance, and disparity in land values, difficulty of exchanging irrigated and rainfed lands and lack of trained persons to carryout the work of consolidation.

Reorganisation of agriculture It is essential to benefit the small and marginal farmers, the share croppers and the agricultural landless workers. During the first three plans, these were sought to be done through co-operative farming societies. But they could not be

formed due to the personal rivalries and caste and status distinction in villages. Fourth Plan therefore, adopted the Small Farmers Development Agency (SFDA) in 1971. The Integrated Rural Development Programme (IRDP) was introduced in 1976-77 to assist the Small and Marginal Farmers, share croppers and landless agricultural workers.

Critical Appraisal of Land Reforms Though the land reform measures adopted in India are comprehensive, their progress has been highly unsatisfactory. The Sixth Five Year Plan document admits “it has not been due to flaws in policy but to indifferent implementation”. The reason for the failure is:

- Lack of effective implementation of application of ceiling laws, consolidation of holdings and in not vigorously pursuing concealed tenancies/occupancy rights as enjoyed under the law.

- Not much effort has been made to assist the allottees of surplus land to develop the land despite the existence of the centrally sponsored scheme of assistance and SFDA and IRDP programmes.

- Organisational inadequacies and lack of resources have presented the work of compilation correction and updating of land records about ownership and rights of tenants, sharecroppers and other land holders.

There are flaws in land reform laws and there has been slow disposal of appeals and revisions filed by landowners against the state revenue authorities.

Chapter 4

CO-OPERATIVE FARMING

A co-operative farming society is one in which members pool their land voluntarily and manage it jointly under a democratic constitution. The seminar on cooperative farming convened by the Indian Society of Agricultural Economics at Poona in May 1958 concluded that " It is an essential element of cooperative farming that its constituent members agree and surrender their individual rights and capacity to take major decisions in respect of farming enterprise to a common body constituted by them and accept its decision".

The Planning Commission of India has also pointed out "Cooperative farming necessarily applies to the pooling of land and joint management. The working group on cooperative farming defines cooperative farming society as "a voluntary association of cultivators for better utilisation of resources including man and land pooled and in which majority of the members participate in farm operations with a view to increase the agricultural production, employment and income. The working group further observed four types of cooperative farming societies are working at present.

Kinds of Co-operative Farming

The Co-operative Planning Committee classified co-operative farming into four types:

Cooperative better farming: The farmers who have smallholdings or limited resources join to form a society for some specific purpose. Eg. Use of machinery, sale of products etc. Profit is not distributed the earnings of the members from his piece of land, after deducting the expenses, become his profit.

Cooperative joint farming: It means the pooling of land and other possible resources. The members form a general body, which formulates the schemes and does the duties of administration. A member receives daily wages for his daily work and the profit in the end is distributed according to his share in land.

Cooperative tenant farming: In this system the land belongs to the society. The tenants have no right on land but they carry on their business independently. A tenant gets all the income after deducting the rent of land and charges for other services provided by the society.

Cooperative collective farming: Members do not have any right on land and they cannot take farming decisions independently but are guided by a general body, which is supreme. Profit is distributed according to the labour and capital invested by the members.

The term co-operative farming may stand for different types, but as we understand here, it refers to co-operative joint farming. Its main features are:

(a) Farmers join the system voluntarily and not through compulsion; (b) they retain their land, in the sense, they never surrender their right to land; (c) they pool their land, their livestock etc., (d) the farm is managed as one unit; (e) the management is elected by all the members; and (f) everyone gets share in the produce according to the land contributed as well a labour performed.

A Critical Evaluation of Co-operative Farming in India

The decision of the Government to set up co-operative joint farms came in for much criticism. Co-operative joint farming was viewed as the first stage to ultimate policy of a switchover to collective farming. In fact, however, the practice of co-operative farming was viewed as the first stage to ultimate policy of a switchover to collective farming. In fact, however, the practice of co-operative farming has revealed that it is being used as a convenient device to by-pass land reforms, help the privileged classes in maintaining status quo and also to use it as a tool for receiving a preferential treatment in the allocation of grants and loans from government agencies. The main points of criticism are:

(1) Failure to make a frontal attack on the existing in egalitarian economic structure. Myrdal, in a sharp comment. argues: “Co-operative farming in the Indian sense is far less radical than ut seems on the surface. Indeed its major weakness is that it produces virtually no change in the status quo. Traditional status distinction between land-owners and landless labourers and share-croppers are maintained and, under the cover of respectability provided by the label co-operation may even become deeply entrenched.”

(2) Co-operative farming societies functioning as joint-stock companies with paid managers help capitalistic agriculture in India. Though theoretically land is pooled, in practice it is not treated as joint property. Owners of land receive an ownership dividend and thus there is a clear recognition of the principle of charging rents and crop-shares from tenants, as was the practice earlier. The principles governing the distribution of produce between the land-owners and workers have never been clearly defined in this country, although ideologically, it was hoped that wages of workers will show an improvement, but the record of co-operative farming societies does not indicate any redistribution of income in favour of the landless peasants, sharecroppers, or marginal farmers. Myrdal condemns the misuse of co-operative farming to subserve the ends of rural aristocracy. Many urban landowners In particular, regard this system as a convenient device for converting sharecroppers into wage labourers, and hence a means whereby absentee owners of even relatively small pieces of land can-without giving up their absenteeism-reap gains from agricultural modernization that are unobtainable when land is cultivated by share-croppers. They can count on receiving the benefits of the preferential treatment and subsidies afforded to co-operatives by governmental agencies... land pooling in co-operatives was expected to protect them against land reform measures, as co-operation is reduced to a mere name when it encourages joint stock farming, a concomitant of capitalist agriculture.

(3) Opposition by Indian bureaucracy. It is hardly possible to carry out reforms with the help of a bureaucracy, which has no faith in them. The community development projects and Panchayati Raj have suffered on this account. Cooperative farming is another victim in this series. Daniel Thorner pointedly states the position in this regard: “At the Centre, in the States, and in the Districts, the administration is manned by men who do not believe in co-operative farming. If anything, they have less faith in this latest Government policy in panchayat and community projects, to say nothing if their hostility to land redistribution.”

To sum up, co-operative farming as practised in India has failed to serve the ends for which it was conceived. By June30, 1970, a total of 8,819 co-operative farming societies with a membership of nearly 2.41 lakhs were working. Hardly 2 per cent of the cultivators have formed into co-operative farming societies and they cultivate barely 4.75 lakh hectares, i.e. barely 0.4 per cent of the total cultivated area.

The National Commission on Agriculture has very rightly summed up the situation in the following words: “The second alternative of development on the lines of total co-operative or collective farming is also subject to serious limitations of a socio-economic and political nature in India today. Such a system can emerge out of social and political revolutions, which can transform the entire national economy in the direction of socialist ownership of property and productive resources accompanied by the establishment of a power structure to ensure maintenance and continuance of socialised property and productive relations based on it... The present socio-economic and political conditions are yet far from that stage of development. Any such attempt may dislocate the existing processes of agriculture without creating a better agrarian set up.”

Chapter 5

WATER RESOURCES: ISSUES, POTENTIALS AND UTILISATION

Water: An Overview

It is hard to believe that this earth in which water seems to be the dominant element should ever face a shortage of water. According to UN estimates, the total amount of water on earth is around 1,400 million km^3 'which is enough to cover the earth with a water layer of a depth of 3,000 metres. However, oceans cover about three-fourths of the earth's surface and nearly 98 percent of earth's water is in the ocean and seas. Fresh water constitutes a very small proportion (2.7 percent) of the total quantity of water available on earth. Of this, 75.2 percent lies frozen in Polar Regions and a further 22.6 percent is present as groundwater, of which again a part lies too far underground to be used. Fortunately, a tiny fraction of the planet's water is renewed and made fresh by nature's solar-powered water cycle. This is available in lakes, rivers, atmosphere, moisture, soil and vegetation. What is effectively available for consumption and other uses is a small proportion of the quantity present in rivers, lakes and underground aquifers.

This supply of water should be juxtaposed against the ever increasing world population, currently estimated to be around six billion, and likely to rise to over eight billion by the year 2050. All the waters flowing in the rivers are not available for beneficial use. Moreover, there are extreme variations in the availability of water over space and time, and they do not necessarily match the variations in human needs. This further restricts the availability of water for beneficial uses. At the end of the twentieth century, the world faces a number of challenges affecting the availability, accessibility, use and sustainability of its fresh water resources. These could have serious implications for present and future generations of humanity as also for natural ecosystems.

The Global Scene

The use of water in the world has increased by more than 35 times over the past three centuries. Globally 3,240 Km^3 of fresh water are withdrawn and used annually. Of this total, 69 percent is used for agriculture, 23 percent for industry and eight percent for domestic use. Water use varies considerably around the world. In Africa, Asia and South America, agriculture is the primary user. Asia uses 86 percent of its water for agriculture, mainly through irrigation, but in most of Europe and North America, domestic and industrial requirements of water exceed agricultural needs.

Even though fresh water is a renewable resource, lit is also a finite resource. This means that the supply per head, a broad indicator of water availability, drops as the population grows. It is clear that water is going to become one of the most sought-after resources in the next century. For obvious reasons, the population pressure will be greater in the developing world than in the advanced nations. Besides, the pace of industrialization and urbanization is adding another dimension to the scarcity.

Clear and wholesome water is a scarce resource, essential for life but so often taken for granted. Managing the water cycle for the benefit of mankind and the environment is one

of today's greatest challenges. In 1989 expert studies (Falkenmark et a]., 1989) ranked countries according to per capita annual water resources (AWR) in each country. They classified countries with an AWR per capita of 1,700 m3 and above as those where the shortage will be local and rare; those with an AWR of less than 1,000 M^3 (which hampers well-being, economic development and the protection of natural systems) as water-stressed countries; and those with an AWR of 500 m3 and below as countries where the water availability is a primary constraint to life. Only seven countries faced water-stressed conditions in 1955. The number rose to 20 in 1990 and 10-15 more countries will be added to the list by the year 2025. Two-thirds of the world's population might face the water-stressed condition by 2050.

At present global per capita availability of both, surface and ground water is about 7,000 m3 per year. However, much of this quantum is available during short spells of rainy seasons due to variability of precipitation in space and time. The AWR, therefore, cannot be put to beneficial use unless held back from flowing waste to the seas. In countries with tropical monsoon type climate, as run of the river in fair weather is low, storages become critical in raising availability all through the year.

Unfortunately, water availability has not received the attention it deserves in global discussions of the sustainable use of natural resources. It has been examined even less little context of population growth. Our capacity for capturing and storing fresh water has expanded throughout history and we are learning how to use it more efficiently. However, no technology can significantly expand the basic resource. The possibility of desalination may seem to suggest that the world's oceans are potentially inexhaustible sources of fresh water, but the process of extracting salt from sea water is expensive and dependent on polluting and non-renewable fossil fuels. The reality is that there is essentially no more fresh water on the planet today than there was 2,000 years ago when the earth's human population was less than three percent its present magnitude of six billion. However, predicted changes in global climate could redistribute or affect water availability and increase the intensity of storms, adding to the challenges of the management of water resources. Efforts to encourage water-conservation face special challenges not encountered in the case of other natural resources. In the major part of the world, water is not controlled by market mechanisms, nor is water a commodity that can be traded internationally like food or other merchandise. Whether people save or wastewater in one region is of no material consequence to those who live in other regions. People need sources, of clean water close to their homes.

Water Resources of India

The rainfall in the country depends on the southwest, retreat and northeast monsoons, shallow depressions and disturbances, violent local storms and occasional cyclones. Most of the rainfall in India occurs as a result of the southwest monsoon between June and September, except in the State of Tamil Nadu, which falls under the influence of the retreat and northeast monsoon during October and November. Rainfall patterns vary greatly depending on the season and the region.

All India average rainfall is 1,170 mm, but it varies respectively from 100 to 11000 mm in Western deserts to North Eastern region. More than 50 percent of precipitation takes place in about 15 days and less than 100 hours altogether in a year. The rainy days may be only about five in deserts to 150 in the North East.

Considering the rainfall, water availability and agro-economic conditions, the Planning Commission (Approach Paper to the Ninth Plan), while emphasising the need for regionally differentiated strategy of agricultural development, suggested the following classification of regions in the country:

- High Productivity Region: Relatively high productivity areas having either well developed irrigation system with moderate rainfall (north-western region of Punjab, Haryana and Western U.P) or v" high assured rainfall(the coastal plains).

- Water Abundant Low Productivity Region: Relatively high rainfall areas with abundant surface and ground water availability, but relatively low irrigation development and low productivity in agriculture (Middle and Lower Gangetic plains, Eastern M.P and North- Eastern Region).

- Water Scarce Low Productivity Region: Low surface and ground water availability, and moderate agricultural productivity (The Peninsular India and Eastern Rajasthan and Gujarat).

- Ecologically Fragile Regions: The Himalayan slopes and desert areas of Rajasthan.

Surface Water

The average annual precipitation in India including snowfall has been estimated as 4,000 kM^3. We have estimated the total annual water resources of the country as 1,953 km^3. Some of this originates beyond our borders, and in turn some of it crosses our borders on its way to the sea and goes into downstream countries like India, which has 2.45 percent of the world's land resources, has roughly four percent of the world's fresh water resources, whereas the country's population is 16 percent of the world's population.

Cherrapunji in the eastern part of Meghalaya receives 11,000 mm of rainfall while western Rajasthan receives only 100 mm. The variability of the rainfall from month to months and year to year for the same place is also very high, and increases in reverse relation to the total rainfall. Even low rainfall areas, especially in some parts of Gujarat and Rajasthan, are prone to occasional high-intensity storms.

Ground Water

Part of the precipitation percolates down into the earth and replenishes the groundwater in the aquifers. Just as surface water is stored in form of tanks, reservoirs and water bodies within the river or drainage channels, groundwater is stored in the aquifers. There are complex inter-linkages between surface water and groundwater. A part of the groundwater may emerge as surface water, and river flows may percolate down as groundwater.

The annual availability of groundwater is determined by the annual recharge of the aquifer (and further recharges over a period of say 3 to 5 years). It follows that water extracted from an aquifer. in any year should be capable of being replenished through recharge from the succeeding precipitations (or other recharge), so that over a cycle of 2, 3 or 5 years, the groundwater table does not go down. When there is over-exploitation of groundwater (which is technically known as mining), the water table goes down progressively. Such over-exploitation has occurred at several places in our country, and has caused ingress of saline waters from the sea in some coastal areas.

Total Availability

It has been estimated that as against a total annual availability of 1,953 kM^3 (inclusive of 432 km^3 of groundwater), approximately 690 kM^3 of surface water and 396 km^3 from groundwater resources, making a total of 1,086 km" can be put to use. So far, a quantum of about 600 Km^3 only out of this available water has been put to use**.** However, pollution problems have been growing, posing a serious threat to availability for use. Municipal sewage (often untreated), urban and rural wastes, industrial effluents, chemical fertilizers and pesticides, has contributed to the pollution of both surface water and groundwater. At the same time, the demand for water will grow with population growth and the processes of economic development. It bias been estimated (as we shall see later in this report) that the available supplies on certain premises will be matched if not exceeded by demand by the year 2050. Water-stress conditions will be experienced in many parts of the country unless remedial measures are taken in time.

Issues and Concerns

As we try to foresee and plan for the future, it is clear that we need to grapple with several critical issues, which are likely to shape our future. Finite availability of water in the face of increasing demand will prompt us to explore all possibilities of bridging the gap between the potential availability and the actual supply. We also realize that even in the optimistic scenario, the task of balancing the availability and the requirement of water will raise major issues of equity and efficiency. Distribution of the available supply between different regions of the country and within the regions between rural and urban areas, or between different sections of population raises questions of prioritisation among various uses as much as the access to water, in quantitative and qualitative terms, at different locations and for different groups of people.

Similarly, we will have to grapple with the issues of efficiency to minimise losses and obtain better results. These issues, in turn, hinge on the strength and flexibility of our legal and institutional mechanisms. They will be profoundly influenced by the economic and technological choices that we make. Above all, these issues would be confronted more satisfactorily to the extent that we are able to evolve a national consensus on the role of different levels of government, institution of civil society and the market.

Water resources are developed for meeting the basic needs like drinking, food production, and energy; clothing fibres, besides requirements for navigation, flood control etc.

An important one is that the preoccupation in the past has been mostly with irrigation. The move away from this orientation towards a larger perspective of 'water-resource planning' is 0 relatively recent development, and has been only partly achieved. There is now a growing recognition that the planning of individual projects must be a part of, and must derive from, a larger plan for a suitable hydrological unit (a basin or sub-basin); that such planning should marry land and water management; that it should be integrated and holistic; that it should be fully 'participatory' and should involve the people at every stage; and that it should be inter-disciplinary. However, this has not happened to any significant extent and there is much to be desired by way of people's involvement in the planning and implementation processes.

Displacement and rehabilitation, again, are areas of concern. In the past these were not bandied well. There is increasing appreciation of the need for enlightened policies in this

regard, but in actual practice the proper implementation of these policies presents difficulties.

Even from a conventional, techno-economic point of view, there have been serious deficiencies in project planning and execution. The processes of project preparation, examination, appraisal and clearance leave much to be desired in terms of rigor and timeliness. Financing and monitoring are inadequate and post-completion evaluations are few. These are compounded by narrow political considerations, not to speak of the problems of collusion and corruption.

Irrigation projects, in general, have become poor revenue-earners (in fact in financial terms, they are loss-makers) because of low water rates and still lower collections. The recommendations of various commissions and committees for a revision of water rates on certain principles have largely remained unimplemented due to lack of political support. Systems built at great cost are allowed to fall Into a dilapidated state. Together with the unresponsive methods of governmental functioning, this renders the system inefficient and unreliable as a provider of water, which in turn makes the user reluctant to accept any Increases in water rates, thus setting in Motion a vicious circle.

Over the decades the state's capacity for maintaining and operating large irrigation systems and providing a satisfactory service to the farmers has come under severe strain. All this, and the activities of many NG0s as also growing feeling that the role of the state should be reduced and the area of management by the people enlarged, has led to a movement for a transfer of the responsibility for the management of irrigation systems at a certain level to Water Users' Associations (WUA). This has come to be known as Participatory Irrigation Management (PIM) or Irrigation Management Transfer (IMT).

If we leave the area of large projects and look at minor irrigation and still smaller local water management systems, we come across two sets of problems. The first is a cluster of issues relating to groundwater exploitation. There are areas where canal irrigation in places well endowed with groundwater has led to a rise in the water table and the emergence of waterlogging and salinity problems. There are other areas where groundwater is being mined, i.e. extracted at a rate exceeding that of re-charge, leading to the gradual depletion of the aquifer, and in coastal areas to the incursion of salinity from the sea.

The second cluster of issues relates to traditional community-managed systems of water management (for instance, the tank systems in different parts of the country, the phad system of Maharashtra and the stepwells of Rajasthan). For a number of reasons the physical structures have fallen into disuse and disrepair, and the old traditions and habits of community-management have been almost lost. In recent years, however, there has been a growing body of opinion in favour of restoring and rehabilitating the old systems and reviving the tradition of community management. There is also a movement towards local water-harvesting and watershed development initiatives in various States.

Turning now to questions of equity, we are faced with a whole range of issues. First, in the context of large projects there is the question of the inequitable incidence of costs and benefits; one set of people that is, those in the submergence area (quite often poor people belonging to tribal communities or weaker sections of society), bear the social costs of the project (displacement, loss of livelihood, etc.), and another set of people,

those in the command area, enjoy the benefits. Efforts to give the former a share in those benefits and to regard them as 'partners in development' have been inadequate. Secondly, communities living upstream and around reservoir areas also have water and energy needs and are entitled to expect the authorities operating the reservoir and power station to meet them; but this is not readily recognized.

Among the most important issues that need consideration in relation to water-resource planning is that concerning the role of women? The role that women (including even the girl-child) actually play in fetching water, often from distant sources, and managing water in the household, is well known. Giving them a voice in water-resource planning, consulting them in the formulation of schemes or projects, 'empowering' them in the newer institutional arrangements that are coming into being (such as WUAS), and so on, are among the matters that demand attention.

Other matters calling for urgent attention include the sharp deterioration of water-quality (in rivers, surface water-bodies, underground aquifers, and in public water supply systems), the hazards that this poses to the health of the nation, and the ineffectiveness of the law and institutions that are meant to be safeguards against these possibilities; and the shocking waste of water in all uses - agricultural, industrial, municipal, domestic - and the total absence of an awareness of the scarcity of this precious resource. The protection of the water-sources (mountains, streams, forests, wet lands, underground aquifers) is another important concern. Floods give rise to some difficult issues: is flood control feasible? Should we learn to live with floods? Have embankments been good or bad? Why are people in some areas questioning the utility of embankments? What are the measures needed for ensuring that the damage caused by floods is minimized? Is flood plain zoning feasible?

The critical questions to the policy makers are: how are the needs of the water-short areas of the country to be met? To what extent can this be done through local water-harvesting and watershed development approaches? Should water be transferred to such places from long distances? What local drought-proofing measures can be taken? What types of economic activity and what kinds of water-use should be encouraged in arid or drought-prone areas?. Even now, despite decades of planning and the institution of 'Missions', there are large numbers of what are known as 'no source' villages, i.e. villages without a source of safe drinking water within a reasonable distance. How is this unacceptable situation to be remedied within a short period of time? The National Water Policy assigns the highest priority to drinking water, but what does this mean in practical terms? What steps does this entail?

National Water Policy

A National Commission on water resources planning has to perform its task with reference to certain policy framework. The basic reference document in this regard is the National Water Policy (NWP) approved and adopted by the National Water Resources Council (NWRC) in September 1987.

Having regard to the importance of water the federal structure of the country, and the nature of the allocation of responsibilities in respect of water in the Constitution, the need for a national consensus on a policy framework is clear. It was an awareness of this that led to the formulation of the NWP 1987. The aim was to get all the States to subscribe in broad terms to a minimal set of Propositions of a general nature, which could then form an agreed basis for more detailed policy- making and action plans.

National consensus of a kind was indeed achieved, and the NWP was adopted in 1987. The statement that water was a national resource is qualified by the expression "subject to the needs of the States". Similarly, the document envisages planning for a Hydrological unit such as a basin or sub-basin, but refrains from mentioning River Basin Authorities or Commissions, doubtless because of apprehensions on the part of the States that their own powers could be eroded. A reference to the optimal use of available water resources stands qualified by the words 'having regard to subsisting agreements or awards of tribunals". Secondly, certain aspects or areas are not covered in the NWP.

Thirdly, more than a decade after the adoption of the NWP, the operationalization of the policy has not made much headway; it still remains largely a set of general propositions. Fourthly, some of the current concerns and issues were still of fairly recent origin when the document was being formulated and have been much more sharply articulated since then. They, therefore, do not find a place in the policy.

It is clear that if the NWP were being drafted today, it would need to show a much greater awareness of the present climate of opinion in regard to many matters such as environmental and ecological issues, 'sustainable development', questions of displacement of people and their rehabilitation, the impact of developmental activities on disadvantaged sections of the society and on tribal communities, the need to remove women's disabilities and 'empower' them, and so on. The increasing acceptance of ideas such as a 'participatory' approach to project planning, the involvement of 'stakeholders', the need for public hearings, the transfer of the management of irrigation systems at a certain level to farmers' associations, and so on, would need to be recognized. The growing awareness of the importance of local water-harvesting and watershed development activities, the imperative of social mobilization in this context, the 'success stories' and other experience in' this regard and the need for a replication of these into a national movement, would need to be reflected. The rediscovery of value in traditional systems of water harvesting and management and the movement for restoring the role of the community in the management of common resources would need to be taken note of. The recognition of access to water as a basic human right, and a profound concern for equity and social justice, will have to be reflected in the policy.

It would also be necessary to go into some other issues left out of the existing NWP. A new dimension has been added to this by the advent of Panchayats as one more tier in the federal structure, as also by the movement, not yet very strong, for empowering the people'. Moreover, considering the fact that in recent years, the process of 3djudication of inter-state river water disputes has run into serious difficulties, it may be useful to set forth the changes needed in the adjudication system. Lastly, some of our important river systems are trans-boundary systems and involve negotiations with neighbouring countries (Nepal, Bangladesh); the new policy may have to take note of this dimension.

Two concluding observations may be made. The first is that the concerns and considerations outlined above seem to call for a fresh exercise of drafting a policy document rather than going in for amendments and additions. The second is that the policy document will need to be accompanied by a detailed blueprint for converting its generalities into operational plans; without such a blue print, the whole exercise of redrafting the NWP may not achieve its purpose.

Development and Management Issues

During the last five decades, food production and gross irrigated area increased four fold. Large and widespread programme of implementation of irrigation development and management has also created several problems concerning equity, environment, lack of drainage, lag in utilisation and efficiency. Various ameliorative measures including rehabilitation of existing schemes, regulation and control of use of water. There was initially considerable lag in irrigation utilisation. Command Area Development Authorities were, therefore, created and micro channels were sought to be extended right down to the field, partly at government cost and partly through input by the farmers.

There are also other issues such as inadequate drainage, inequitable distribution of water between the head reach and tail end areas, the distribution and control of inter-state river waters, which have created disputes among the basin states and regional inequalities. All such issues of development and management must be identified and appropriate measures taken to improve the efficiency of water use and ensure equity while meeting water requirements without adversely affecting the environment.

Development of Irrigation under the Plans

In the First Five Year Plan (1951-56), the country launched a major irrigation, programme. A number of Multipurpose and Major Projects were taken up, such as Bhakra Nangal, Nagarjunasagar, Kosi, Chambal, Hirakud, Kakrapar and Tkingabhadra. Simultaneously, minor irrigation schemes including ground water were given emphasis under the Agricultural Sector, along with financial assistance from the Centre.

During the periods of second Five Year Plan (1956-61), Third Five Year Plan (1961-66) and the Three Annual Plans (1966-69), irrigation programmes were being implemented with new starts. During the Fourth Five Year Plan (1969-74), the emphasis was shifted to the completion of ongoing projects, integrated use of surface and ground water, adoption of efficient management techniques and modernization of existing schemes. The new starts, however, continued. During the Fifth Plan (1974-78), Command Area Development Programme was launched as a Centrally Sponsored Scheme with the objective of reducing the fag between potential created and optimum utilization of available land and water. The programme was conceived as a means of co-ordinating all related activities to meet with these objectives under one umbrella.

During the Annual Plans of 1978-80 and the Sixth Five Year Plan (1980-85), new starts continued and at the end of Seventh Plan, there were as many as 182 major and 312 medium ongoing projects requiring an estimated amount of Rs.39,044 crores at the 1990-91 price level for their completion. New starts were, therefore, restricted considerably and greater emphasis was laid on completion of projects, which were in the advanced stages of completion (those with an expenditure of 75 percent or more). This was continued during 1990-91, 1991-92 Annual Plans and the Eighth Five Year Plan (1992-97). Rehabilitation and modernization of old irrigation schemes gained momentum. User's participation in major and medium irrigation schemes received greater attention. Repairs and improvement to the minor irrigation projects, as a part of integrated micro-development, also received encouragement. Similarly, sprinkler and drip irrigation programmes and the conjunctive use of surface and ground water gained momentum. The projects completed, along with minor irrigation and groundwater development, have created an estimated potential of about 90 mha, by the end of eigth plan.

Table.5.1. Magnitude and composition of Investment through Plan periods in Irrigation and Flood control (Rs.in crores at current price level)

Plans	Major/ Medium	Minor irrigation			CAD	Flood control	Total
		Public sector	Institutional Finance	Total finance			
First (51-56)	376.24	65.62	neg	65.62	..	13.21	455.07
Second (56-61)	380	142.23	19.35	161.58	..	48.06	589.64
Third (61-66)	576	327.73	115.37	443.10	..	82.09	1101.19
Annual (66-69)	429.81	326.19	234.74	560.93	..	41.96	1032.70
Fourth (69-74)	1242.30	512.28	661.06	1173.34	..	162.04	2577.48
Fifth (74-78)	2516.18	630.83	778.76	1409.58	..	298.61	4224.36
Annual (78-80)	2078.58	501.50	480.40	981.90	362.96	329.96	3753.40
Sixth (80-85)	7368.83	1979.26	1437.56	3416.82	743.05	786.85	12315.55
Seventh (85-90)	11107.29	3118.35	3060.95	6179.30	1447.50	941.58	19675.67
Annual (90-92)	5459.15	1680.48	1349.59	3030.07	619.45	460.64	9569.31
Eigth (92-97)	21071.87	6408.36	5331.00	11739.36	2145.92	1961.68	36648.83
Ninth (97-02)	43034.96	9314.84	..	..	3012.79	1078.52	56441.11

Source: Reports of the Working group of Ninth Five Year Plan

Table. 5.2.Development of Irrigation Potential through Plan periods

(in million hectares)

Plans	Major/Medium		Minor irrigation		Total irrigation		Gross
	Potential	Utilisation	Potential	Utilisation	Potential	Utilisation	irrigated area
Pre plan	9.70	9.70	12.90	12.90	22.60	22.60	22.56
First	12.20	10.98	14.06	14.06	26.26	25.04	25.64

(51-56)							
Second (56-61)	14.33	13.05	14.75	14.75	29.08	27.80	27.98
Third (61-66)	16.57	15.17	17.00	17.00	33.57	32.17	30.90
Annual (66-69)	18.10	16.75	19.00	19.00	37.10	35.75	35.48
Fourth (69-74)	20.70	18.69	23.50	23.50	44.20	42.19	40.28
Fifth (74-78)	24.72	21.16	27.30	27.30	52.02	48.46	46.08
Annual (78-80)	26.61	22.64	30.00	30.00	56.61	52.64	49.21
Sixth (80-85)	27.70	23.57	37.52	35.25	65.22	58.82	54.53
Seventh (85-90)	29.92	25.47	46.61	43.12	76.53	68.59	61.85
Annual (90-92)	30.74	26.32	50.35	46.54	81.09	72.86	65.68
Eigth (92-97)	32.96	28.44	56.60	52.32	89.56	80.76	70.64
Ninth (97-02)	42.77	36.15	63.84	57.24	106.61	93.39	NA

Source: Ministry of Water Resources and Reports of Working Groups and Ninth Five Year Plan Proposals for various states.

The Ninth Plan

The overall strategy of irrigation development and management during the Ninth Plan has the following core ingredients:

- To improve water use efficiency by progressive reduction in conveyance and application losses and to bridge the gap between the potential created and its utilisation by strengthening the Command Area Development Programme (CADP), institutional reforms and promoting farmers' involvement in irrigation management,

- To complete all the ongoing projects, particularly those which were started during pre-Fifth Plan and Fifth Plan periods as a time bound programme to yield benefits from the investments already made,

- To restore and modernise the old irrigation systems which were executed during the pre- independence period and 25 years ago,

- To introduce rational pricing of irrigation water, based initially on O&M cost and then to encourage higher level of water use efficiency,

- To take concrete steps towards comprehensive and integrated development of natural water resources, taking into account the possibility of inter-river basin transfer of surplus water,

- To promote adaptive research and development to ensure more cost effective and efficient execution and management of irrigation systems,

- To promote Participatory Irrigation Management (PIM) with full involvement of the water user community, which will be at the centre stage of implementation of above strategies of the Ninth Plan,

- To encourage and implement the conjunctive use of ground and surface waters towards optimal utilisation of water resource and to have its development environmentally sustainable as well,

- To accelerate the development and utilisation of ground water particularly in the eastern region on sound technical, environmental and economic considerations along with proper regulatory mechanisms.

Table. 5.3.Physical targets set in the Ninth Plan

Targets	Additional irrign potential (mha)	Additional utilization (mha)
Major/Medium	9.81	8.71
Minor	7.24	4.93

Source: Ministry of Water Resources and Reports of Working Groups and Ninth Five Year Plan Proposals for various states.

Categories of Irrigation Projects

Major Irrigation Projects :Those having C.C.A. of 10,000 ha or more.
Medium Irrigation Projects :Those having C.C.A. between 2,000 ha to 10,000 ha. Minor Irrigation Projects :Those having C.C.A. of 2,000 ha or less.

Gap between potential and utilization

One of the major criticisms of irrigation management is about the large gap between potential created and its utilization. The reasons leading to the lag in utilization have to be gone into. The objective should be to devise a system under which correct figures of potential and utilization are reported and measures recommended for reducing the period of lag in utilization.

Normally the potential created during a particular year cannot be fully utilized during that year. The utilization develops gradually attaining its full value by the end of about five years. It is evidenced that at the beginning, the cumulative irrigation potential created was 65.22 Mha. The end of the Plan should have obtained full utilization of this in 1990. In addition, 60 per cent of the new potential (11.31 Mha) added during the Seventh plan period should have been utilized. Thus, the total utilization should have been 65.22+0.6(11.31)=72 Mha. As compared to this the actual utilization was 68.59 Mha. The gap of 3.41 Mha is therefore such as could have been avoided by undertaking suitable structural and managerial measures. The issue, therefore, requires critical examination.

The possible reasons for the gap between potential and utilization are:

- *Lack of uniformity in reporting potential*: There is no uniformity about the definition of irrigation potential all over the country. Some states report net potential and some report gross annual potential. Again, some report the areas covered down to the end of government channels, while others report the potential only when the field channels are constructed. Secondly, areas are often reported even if part systems are completed but water is not able to flow due to some physical constraints (non-availability of an intermediate patch of land or non-completion of an on-line structure etc.,).

- *Lack of uniformity in reporting utilization*: There is no uniformity in reporting the utilization figures also. As utilization depends on availability of water, it would vary from year to year even if the system is physically complete. As such many states report all time maximum figures irrespective of the actual utilization during the reported year.

- Lower utilization due to system deficiencies and non-availability of water from supply side.

- In irrigation department statistics, the utilization is not taken as actual utilization in the reporting year but as maximum utilization of irrigation in previous five years. Thus, the figures reported are higher.

- If a farm is partly by surface water and partly by groundwater in the same crop season, the same may have been double counted for both surface and groundwater by the state.

- For minor irrigation, especially wells, the figures reported by the states may not be accurate. For example, in the case of groundwater, the percentage of mortality assumed for calculation may be much lower than the actual mortality in the field.

Operation and Maintenance

Operation of the water delivery system calls for systematic studies of the cropping pattern in the command area including its trends in the command area and the crop water requirements. Equity, timeliness and efficiency in distribution of water are the three main attributes of successful operation. The operational strategy has to meet the fortnightly requirement of water throughout the crop season. The main canal, branches and distribution system, more or less, cater to the average requirements of water during the rotational period.

In an ideal condition the quantity of water to be supplied to the crop should be just sufficient to meet its consumptive evapotranspiration requirements at various stages of growth. Due to physical limitations involved in storing, conveying and applying the water in the field, much more water than actual requirement of the crop has to be released from the storage.

There is a general belief amongst the farmers that greater the depth of flooding in the field, the better it is for the crops. This may partly be due to the fear that next watering may be delayed. Irrigation operators have to convince the farmers that over-irrigation results in reduced production and may cause water logging and Stalinization. In fact, if 'x' is the optimum quantity of water in terms of delta required for bringing crop to maturity, reducing the supply to about 80 per cent of ‘X’ will only result in a marginal loss of productivity but the balance 20 per cent will bring corresponding larger area into irrigation, thus contributing to sizeable overall production and at the same time, satisfying the irrigation needs of larger population besides reducing the risk of waterlogging.

Water Use Efficiency for Irrigation System

The overall efficiency of a system is measured by the extent of water actually used by the crop out of the water released from the reservoir. This overall efficiency (E) is made up of partial system efficiency which include (i) conveyance efficiency (Ec) which is the ratio of the volume of water delivered to the distribution system to the volume released from the storage (excluding water drawn from the system of non-irrigation uses, if any), (ii) distribution efficiency (Ed) which is the ratio of the volume of water delivered to the fields to the volume of water delivered at the head of the distribution system (excluding non-irrigation uses in the distribution system) and (iii) field application efficiency (Ea) which is the ratio of the actual volume of water required by the crop to the volume of water delivered to the field. The overall efficiency E can thus be defined as

$$E = Ec \times Ed \times Ea$$

The overall efficiency can be high if the losses in the system can be minimized. The losses during conveyance and distribution occur of seepage and evaporation, leakage from structures, evapotranspiration through weeds, pilferage of water, operation of escapes, non-use of water by irrigators during night resulting in wastage at tail etc. Losses in fields occur on account of inadequate land levelling and land shaping, deep percolation, overflow over field dykes, evaporation from the field and the differences in the water use efficiencies of different methods of application like border, strip, basin furrow, flooding field to field etc.,

Steps like lining of the system, provision of adequate control structures, prevention of leakages and pilferage, rotational supplies with obligatory night irrigation, undertaking

adequate CAD and OFD works and training of farmers for efficient water application practices can considerable improve the overall system efficiency.

Water Accounting

At specified definite locations of the canal and delivery systems complete records are kept of water withdrawn from the reservoir or the river system as well as the water which flows through the various branches, distributaries and other net work channels and at outlets as well as water flowing through escapes. Simultaneously, the records are kept of the crops and corresponding areas irrigated and depth of watering applied.

Preparation of Plan of Operation and Maintenance (POM)

The plan of systematic operation and maintenance is a sine qua non for efficient management of irrigation. POM requires a dynamic view taking into consideration the trends, both past and future. The objectives of POM ate:

- to achieve stipulated levels of services including maintenance at minimum achievable cost; and optimum use of canal water,
- to provide detailed O&M guidelines during various anticipated scenarios of water availability, including equitable water distribution up to the tail end of the system,
- to effect efficient co-ordination of staff, equipment, physical and financial resources and related disciplines, active Involvement of farmers etc. and
- to establish guidelines to achieve the set objectives, treating all project facilities as integral parts of the project.

Role of Drainage in Operation

In several projects undertaken in recent years, the drainage component of the schemes had been deferred. While this had reduced the initial expenditure on the project, the drainage aspect was subsequently lost sight of during the operational stage till waterlogging and salinity were noticed. In many cases where drains have been provided, they are not being adequately maintained. They get silted up and are often used by farmers for dumping the waste materials. Often new developmental construction works in the command impede drainage. Maintenance and remodelling of existing drainage systems, therefore, is a high priority task. Ideally, comprehensive drainage master plan for the entire project should be prepared simultaneously with the canal network planning and the excavation of the drains should also be taken up along with the construction of the canals so that the soil from the drain excavation can be useful for canal banks and the drainage network becomes ready along with the canal system.

Role of Monitoring Waterlogging and Salinity in Operation

The operational staffs are expected to monitor the quality and levels of ground water movements over a period of time. Soil chemistry should also be checked periodically to assess the salt levels. Where the water table is found to rise to an alarming level, steps must be initiated in advance to reduce input of water by restricting the water supply and by changing the cropping pattern as well as by conjunctive use of ground and surface water.

The maintenance of irrigation systems includes preventive maintenance, operative maintenance and special repairs and disaster maintenance.

Strategies to overcome the problems

The uncontrolled exploitation of ground water had resulted in various undesirable consequences affecting equity, efficiency and sustainability in ground water use. Thus formulation and implementation of policies will help to achieve the social objectives of equity, efficiency and sustainability of water resources.

- New strategies for water development and management are urgently needed to avert severe national, regional and local water scarcities that will affect agricultural production, damage to environment and leads to health hazards. Improved conservation of water can only be achieved through comprehensive reforms of water policy and demand management.

- Strategies to overcome the crisis should be looked into two angles. Some of the increasing demand for water must be met through management of surface water and optimum use of ground water resources. Conjunctive use of surface and ground water should be achieved.

- Improving the distribution efficiency can minimize losses in the distribution network. This may cover the future demand to cope with the increasing population.

- To alleviate water poverty, other water resources may be made available through efforts such as seawater agriculture and recycling of agricultural drainage. To bring more area under irrigated agriculture an appropriate and low cost technology is needed for desalinisation.

- It is very essential that environmental and social costs should not exceed the benefits. Hence, steps should be taken to safeguard water by maintaining and improving surface and ground water quality.

- Irrigation management is an important aspect to be considered. In spite of the growing realization of the urgent need for farmers' association in the management of irrigation, the progress has been slow so far. It is estimated that Water Users Association is managing today only 8.04 lakhs hectares. Farmers' participation in the management of irrigation system would be a useful exercise in the long run. Involving the farmers in the irrigation system is one obvious remedy for addressing the management problems.

- New water technologies should be disseminated for adoption like scheduling irrigation based on crop water requirement, improving water use efficiency, conveyance efficiency and popularisation of micro irrigation system. This calls for educating and impart training to the farmers. Soil and moisture conservation technologies should be demonstrated to the farmers so as to achieve improved water use efficiency.

- Rules and regulations should be formulated in respect of depth of wells and spacing between wells that will help in a greater extent to improve the efficiency i.e. this will help to reduce the pumping hours and area irrigated by wells.

- The adoption of micro irrigation system such as drip irrigation may be geared up vigorously in extreme drought regions. Promotion of agroforestry in the wastelands will help in big way to enhance direct recharge of rainfall into ground.

- Watershed programmes to augment the groundwater recharges. Wherever the check dams and percolation ponds are feasible, they should be encouraged with active involvement of local people for construction and maintenance after words.

- Water disputes, which are underway in many states, may be resolved so as to thwart top sided development and to secure equity. Creative ideas and actions are required to manage local, regional and national water conflicts. National water policy reform is a key to defuse potential conflicts over water and to ensure the most efficient use of available water supplies.

- A strong political will of government to frame appropriate water policy and equally important indomitable conscience of water uses to utilize water judiciously are absolutely necessary for sustainable utilization of water.

Implementing these policies effectively will pave way to solve the problems of growing water scarcity in the country and help to achieve the societal objectives in terms efficiency, equity and sustainability.

Chapter 6

ENERGY SECTOR IN INDIA

Energy is an essential input in all production and many consumption activities. With existing technologies, increasing per capita productivity is needed to increase per capita income which inturn requires increased amount of energy. In fact, without an assured supply of energy, rapid economic development is not likely. The crucial role-played by the availability of energy and other infrastructure in stimulating investment and modernisation has been recognised right from the first Five Year Plan. Even then, over the years, the energy problem has been a major problem in India. By energy problem we mean the problem of providing fuels or energy in its various forms at reasonable cost to those who need them, wherever they are (Parikh and Parikh, 1992).

Broadly there are two sources of energy namely, commercial and non-commercial energy. Commercial sources of energy consist of coal, petroleum and electricity. These sources are commercial in the sense that they command a price and the users have to pay for them. It accounts for nearly 50 per cent all energy consumption in India. Non-commercial sources consist of firewood, vegetable wastes and dried dung. Both the commercial and non-commercial sources are called conventional source of energy. There are three other sources of energy, which are commonly called as non-conventional sources of energy. They are solar, wind and tidal power.

The different sources of energy produced are used by different activities as it flows from production to consumption point (Parikh, 1980). Fig.1 illustrates this energy transformation. Primary energy is a gift of nature and hence, each energy resource is considered according to its calorie equivalent terms. This energy goes through central conversion facilities such as refineries, power plants etc., the outcome of which are secondary energy forms and are different from the original primary energy forms (eg. Electricity from coal). Final energy is what consumers buy, i.e. secondary energy, exclusive of distribution losses. Useful energy is that which is finally delivered to the system through energy utilisation equipment. In general, equipment that uses oil or electricity or even coal is relatively efficient where as equipment that uses non-commercial energy (wood, wastes, dung etc) in developing countries is not so efficient. Useful energy can be calculated by considering the form of primary energy used and the purpose. In terms of primary energy, the contribution of non-commercial energy to total primary energy would be high and that of oil would be small. But, when considered in terms of useful energy, the contribution of non-commercial energy would decrease, while that of oil would increase. It can be seen from the figure that an integrated approach concerning the energy demand and supply system can helps to identify steps which connect the appropriate primary energy forms with the required useful energy so as to increase the efficiency of the entire energy system.

The per capita consumption of energy is very low (234 kgs of oil equivalent) when compared to the developed economic like U.K (3743 kgs of oil equivalent), Japan (3586) and USA (7615 kgs of oil equivalent). Thus there is a direct correlation between the degree of economic growth and the size of per capita income and per capita consumption of energy. It lucidly shows that growth and development of an economy and the energy sector are highly interdependent. Keeping these issues in view, the present paper aims to analyse the performance of the energy sector and their problems and policy issues.

Energy scene in India

India is endowed with abundant primary sources of energy, though its distribution varies in quantities and across regions. The energy sector comprises the power, coal, oil and non-conventional energy sectors. It claims the largest allocation in one five year plans. It's share ranges from 23 per cent to 30 per cent of to public sector Five Year Plan allocation. Of all the sub sectors, the investment on power sector takes huge share and it ranges from 13 per cent of 22 per cent of the total outlay. (Table.6.1).

Table. 6.1.Investment In Energy Sector

(Per cent distribution)

Particulars	Sixth (80-85)	Seventh (85-90)	Ann.Plan (90-91)	Ann. Plan (91-92)	Eighth (92-97)	Ann. Plan (98-99)
1. Power	19.8	19.0	19.5	22.4	18.3	13.9
2. Petroleum	4.4	7.0	6.2	5.2	5.5	7.5
3. Coal	2.9	4.1	3.4	2.6	2.4	1.7
4.Renewable sources of energy	0.1	0.3	0.2	0.3	0.3	0.4
Total energy	27.2	30.5	29.3	30.5	26.6	23.5

At the same time, oil imports usually have the significant share among total imports. On the other hand, the demand side is highly vulnerable in that all sectors require energy as an input for various economic activities. These primary energy sources include coal, lignite, crude oil, natural gas, uranium, biomass and non-conventional energy sources. The potentials of various energy sources are presented in Table. 6.2.

Table . 6.2.Potential of Different Energy Resources in India

RESOURCES	UNIT	POTENTIAL
Hydro electric Conventional	MW	84000
Pumped storage	MW	93920
Micro	MW	5000
Coal	Bill.mt	186
Lignite	Bill.mt	26
Crude oil	MMT	728
Natural gas	Bm3	686
Uranium	Mwe	10000
Biomass	Mwe	6000
Non. conventional	Mwe	20000

Source: Alagh.Y.K. 1998.

The hydel resources available in the country are capable of generating 600 Twh of electricity constitutes 6 per cent of the total hydroelectric potential available in the world. A substantial portion of the available hydel potential in the country is located in the ecologically sensitive regions of Himalayas. There are many environmental concerns that are presently being voiced against the large hydroelectric projects being undertaken. Coal and lignite reserves in it country also are substantial and they constitute about 6 per cent of the total known coal reserves of the world. The established oil and gas resources are largely available in the offshore area of the country but at the present production levels of these reserves may not last for more than two to three decades. At present they constitute less than one per cent of the total hydrocarbon reserves of the world.

Even though India has sizable energy resources in terms of coal, lignite, hydroelectric and nuclear energy, the process of development of these resources is fraught with major technological and environmental problem. With its large and steadily increasing population and to urgent need to step up the per capita energy availability to reasonable levels, the energy requirements of the economy are going to increase rapidly. Since the domestic energy resources particularly hydrocarbon are not that abundant as to be sufficient to sustain the increasing demand for energy, the country may have to depend on energy imports in long run. Thus it is crucial that the country should be in a position to minimise its dependence on imports and ensuring energy security by way of enhancing the energy use efficiency and management of energy conservation.

Power sector

The power sector in energy is a crucial sector of the economy because electricity cannot be easily imported or stored and hence, generation of domestic power capacity is critical for meeting the country's demand for power. Electric power is an essential ingredient of economic development and it is required for commercial and non-commercial uses. Commercial uses refer to the use in industries, agriculture and transport. Non-commercial uses include electric power required for domestic lighting, cooking uses of mechanical gadgets like the refrigerators, air conditioners etc. If the capacity additions are not done in time, power shortages, result in the system which leads to inefficient operations and management, decelerate investments in other sectors of the economy and hamper the growth process of the country in general. In India, the endemic power shortages and cuts leads to inadequate capacity utilisation, unproductive expenditure such as in back-up generators and much waste, all of which impose a major constraint in economic growth and development.

The power sector has been given due importance right from the first Five Year Plan. In the first Five Year Plan share of budget outlay of power sector is 13 per cent, and it has been consistently increasing across Five Year Plans. For example, from Fourth Five Year Plan onwards it ranges between 19 per cent and 22.4 per cent of the total budgeted outlay. This clearly shows the importance given to the power sector of the economy. Over the period between 1950-51 a 1998-99, the total installed capacity has increased from 2.3 to 107.8 thousand MW, and the total electricity generated increased from 6.6 to 494.4 Billion KW. As far as the electricity consumption is concerned, the industrial sector forms the major consumer of power followed by domestic consumer and agricultural sector. The adoption of modern technologies and development of major and minor irrigation projects increased the area under crops and productivity leading to increased consumption of power across periods. The percentage consumption of power by agricultural sector consistently increasing from 3.9 per cent to 30.5 per cent during the period between 1950-51 and 1998-99. Though huge resources are mobilised for power sector in the economy, still the shortages of electricity persist. There are endemic power shortages and the Indian power sector has not been able to match the growing needs for more generating capacity. Over the next five years, it needs to add another 35,000 to 50,000 MW of capacity depending on the growth rate of the economy (Parikh, 1997).

The financial sickness of the State Electricity Board is found to be the major cause for acute shortage of electricity. Most of the State Electricity Board make losses and some are even unable to cover the input costs like coal or power purchased. This is mainly due to the State Electricity Boards have often implementing subsidy policies of the state governments leading to inefficient patterns of energy consumption and even to non-recovery of their own costs. Subsidy given to agricultural sector will reduce resource mobilisation for investment in power sector. The subsidies provided though cheap electricity to the agricultural sector increased from Rs. 4.56 billion during triennium ending 1982-83 to Rs. 93.56 billion during 1994-95 (Suresh kumar, 2000). Also, there is lot of

theft of power from the distribution networks, which is called transmission and distribution losses. The loss due to subsidy to agricultural consumers alone increased to Rs. 7000 crores per year. Thus apart from the current losses, the subsidies have serious repercussions for future investments as well. It is therefore necessary to consider the reduction in electricity subsidies provided to agricultural and other sectors of the economy.

With the growth of population and with the increase in the use of modern gadgets, the demand for electricity for domestic use grows at a faster rate. Besides, growth and development in industrial sector particularly Information Technology industry agricultural and service sectors of the economy further increase the demand for power. In order to meet the gap between the demand and supply for power, the government of India formulated a policy in 1991 to attract domestic and foreign private investment in power sector. This again raised some critical issues regarding the price of power, guaranteed availability and choice of least cost project. In order to solve the problems of power sector, the state and central governments have to implement measures to solve the problems of energy conservation.

State Electricity Board in order to improve power generating capacity and the State Electricity Boards must lay more emphasis on reduction in transmission and distribution losses. The problem of power shortages could also be sowed through proper systems improvement called supply side management and reducing demand for electricity called demand side management. The appropriate energy conservation technologies must be developed and investment in energy conservation programmes should be given fiscal incentives such as tax credits and depreciation allowances and credit from public financial institutions at relatively low rates of interest. Private investors can be encouraged in power sector. However government can have control over the private firms in fixing tariffs. Privatisation of existing government power sectors can also be implemented in a phased manner to solve the problems of resource mobilisation.

Coal sector

The coal sector forms one of the important components of energy sector in one country. It is the major fossil fuel resources and it accounts for about 58 per cent of the total primary sources of commercial energy. Indian coal is largely of bituminous grade with high ash content. During the part five decades of planned development, due importance has been given to the development of coal sector. The first step was to the establishment of National Coal Development Corporation in 1956. The investment in coal sector varies from 3-4 per cent of the total budgeted outlay. In eigth Five Year Plan it accounts for 2.4 per cent of the total outlay of budget.

Table. 6.3.Installed Capacity and Power Generated and Consumption in India

Particulars	1950-51	1960-61	1970-71	1980-81	1990-91	1998-99
1. Installed plant capacity (1000MW)						
A. utilities	1.7	4.6	14.7	30.2	66.1	93.3
a. Hydro	0.6	1.9	6.4	11.8	18.8	22.4
b. Thermal	1.1	2.7	7.9	17.6	45.8	68.7
c. Nuclear	..	..	0.4	0.9	1.5	2.2

B. Non utilities	0.6	1.0	1.6	3.1	8.6	14.5
c. Total	2.3	5.6	16.3	33.3	74.7	107.8
2. Electricity generated (Bill-KMH)						
A. Utilities	5.1	16.9	55.8	110.8	254.3	448.4
a. Hydro	2.5	7.8	25.2	48.5	71.7	82.7
b. Thermal	2.6	9.1	28.2	61.3	186.5	353.7
c. Nuclear	..	..	2.4	3.0	6.1	12.0
B. Non-utilities	1.5	3.2	5.4	8.4	25.1	46.0
C. Total	6.6	20.1	61.2	119.3	289.4	494.4
3.Consumption (%)						
a .Domestic	12.6	10.7	8.8	11.2	16.8	20.6
b. Commercial	7.5	6.1	5.9	5.7	5.9	6.5
c. Industry	62.6	69.4	67.6	58.4	44.2	35.5
d. Traction	7.4	3.3	3.2	2.7	2.2	2.3
e. Agriculture	3.9	6.0	10.2	17.6	26.4	30.5
f. Others	6.0	4.5	4.3	4.4	4.5	4.6

To ensure a sustained development of coal sector, huge investment in made since its Nationalisation, in the field of opening up of new mines, reorganisation of existing mines, and development of related infrastructure. The trend in coal production is presented in Table.6.4.

Table .6.4.Production of Coal Sector in India
(million tonnes)

Particulars	1950-51	1960-61	1970-71	1980-81	1990-91	1998-99
Coal	32.30	55.23	72.95	113.91	211.73	292.27
Lignite	NA	NA	3.39	5.11	13.77	23.42
Total	32.30	55.23	76.34	119.02	225.02	315.69

It is seen from the table that the coal production has increased from 32.30 million tonnes to 292.27 million tonnes during the period between 1950-51 a d 1998-99. It is mainly due to the fact that realisation of importance of the coal sector by the government and making huge investment in promoting growth and development of the coal sector of the economy. The production of lignite increased from 3.39 million tonnes to 23.42 million tonnes during the above period. It should also be mentioned that this magnitude of increase in the production of coal is feasible mainly due to greater emphasis was given to open cast mining opencast mines contributed about 28 per cent of the total production in 1973 and increased their share to about 70 per cent in 1995-96 (Parikh, et al, 1997). The major factor responsible in favour of opencast mines is shorter gestation period, high recovery and safety and lower cost of production. However, it seems that the coal produced is of an inferior grade. Indian's underground mines are grossly under utilised because of low levels of mechanisation. High technologies with economies of scale and minimum cost are needed in this direction to extract and use inferior mines. Management of residuals pose environmental problems in extracting inferior ore materials.

Coal mining in India is mostly in the public sector. The major share of the industry is under a corporate set up of the central government, the Coal India Limited (CIL) established following the nationalisation of the industry and it comprises number of subsidiary companies. In production of coal both the underground and opencast technologies are adopted. Bulk of the coal production has taken place from underground mines in earlier years, though the share of opencast mining has steadily increased. Though the coal production scenario is progressive, several problems have emerged in this sector. In spite of the significant increase in coal production, there are regular short falls in coal receipts at thermal power stations, which operate with very little inventory.

Besides, the average quality of coal produced has gone down and mostly of inferior grade. The production of poor quality coal increased from 18 per cent in 1980-81 to about 55 per cent in 1992. It is common experience that the coal received deviates from design values in terms of calorific value and ash content. In addition, the concern for the emission of CO_2, one of the green house gases, poses an additional problem for our coal resource. The value of the resource goes down as coal emits more CO_2 per unit of energy than oil and natural gas (Gokarn and Parikh, 1992). These problems need attention of policy makers to emphasis coal sector and use it with greater effectiveness despite the global concerns for CO_2 emission. In order to achieve this the coal production must increase, quality of coal produced should be improved, and there must be reduction in cost of production and assured supply. Encouraging more private investment will pave way for improving better quality of coal production and increase the resource use efficiency in coal sector of the economy. Disinvestment by the government in coal sector can be allowed in a phased manner and it will improve technical and economic efficiency of these sectors.

Hydro carbon sector

The oil sector has received high priority since the mid seventies. The first oil shock in 1973 changed the flows of India's energy concerns to oil. Oil exploration and production were accelerated to reduce the country's dependence on imported oil. The oil and oil products sufficiently index, which was 5 per cent in 1960-61, has already reached a level of 35 per cent at the time of the oil shock even though the domestic consumption had increased from 8 million metric tonnes to 20 million metric tonnes. The self-sufficiency index peaked to 70 per cent in 1984-85 with a total consumption of 39 million metric tonnes. But in 1990-91, our self-sufficiency ratio has gone down to 60 per cent. Availability of natural gas in India was considered to be very small during seventies, resulted in allocation of available gas was strictly controlled by the government.

Policy of parallel marketing of kerosene and liquid petroleum gas, imports of these products have been decanalised for private sectors. However, shortage of handling facilities at ports and bottling plants has been hampering LPG imports. This creates problem to this sector and attracted the policy makers.

The commodity balance of petroleum and petroleum products in India over the years is presented in Table.6.5.. It is evidenced from the table that the domestic crude oil production has increased from 0.3 million tonnes in 1950-51 to 32.7 million tonnes during 1998-98. Though, the domestic production increases significantly, due to ever increasing demand for the imports has gone up from 6 million tonnes during 1960-61 to 39.8 million tonnes during 1998-99. Similar trend is experienced in petroleum products also as the net imports of petroleum products registered a significant increase from 0.8 million tonnes to 17.4 million tonnes during 197071 to 1998-99.

Table. 6.5. Commodity Balance of Petroleum and Petroleum Products
(million tonnes)

Particulars	1950-51	1960-61	1970-71	1980-81	1990-91	1998-99
A. Crude oil						
a. Domestic production	0.3	0.5	6.8	10.5	33.0	32.7
b. Imparts	NA	6.0	11.7	16.2	20.7	39.8
c. Net imports	NA	6.0	11.7	16.2	20.7	39.8
B. Petroleum products						
i. Domestic production	0.2	5.7	17.1	24.1	48.6	64.5
Naphtha	NA	..	1.2	2.1	4.9	6.1

Kerosene	NA	0.9	2.9	2.4	5.5	5.3
High speed diesel oil	NA	1.1	3.8	7.4	17.2	26.7
Fuel oil	NA	1.6	4.1	6.1	9.4	11.0
ii. Domestic consumption	3.3	7.7	17.9	30.9	55.0	89.4
Naphtha	..	..	0.9	2.3	3.4	6.2
Kerosene	0.9	2.0	3.3	4.2	8.4	10.6
High speed diesel oil	0.2	1.2	3.8	10.3	21.1	36.9
Fuel oils	0.9	1.7	4.7	7.5	9.0	11.0
iii. Imports	3.1	2.5	1.1	7.3	8.7	18.8
iv. Exports	NA	NA	0.3	NEG	2.7	1.4
v. Net imports	NA	NA	0.8	7.3	6.0	17.4

The major problem of oil sector is growing imports of oil and oil products makes our country susceptible to fluctuation in international oil prices. The value of oil imports accounted to 27 per cent of total imports in 1995-96. This also raises concern regarding ensuring oil security for the nation. The another major problem is domestic crude oil production is stagnated for some years and even gone down, as it is evidenced that domestic crude oil production is 33.0 million tonnes in 1990-91, it is decreased to 32.7 million tonnes during 1998-99 (Table.10). This poses a problem of how do we manage our oil resources? Besides, pricing of oil product is highly politicised and full of distortions. It also puts a burden on government exchequer. Enough emphasis must be laid on pricing policy of petroleum and petroleum products. Subsidy given to consumption sector can be removed in a phased manner to solve the financial crisis.

Non-conventional energy sector

The depletion of conventional energy sources and the increasing demand supply gap of power will be one of the most challenging crises, the economy has to face in the new millennium. World over, various actions ranging from the conservation of energy sources to the use of energy efficient methods / equipment and development of various renewable energy sources are in force to save the future generations. India with the huge deficit in power, the ever-increasing fuel cost and the various environmental issues associated with the conventional power generation, it is important to plan for more exploitation of alternate energy sources, which are commercially viable, and environment friendly. In this connection, the non-conventional renewable energy sources assume importance.

There are three sources of energy called non-conventional sources of energy, which are renewable. They include solar energy, wind energy and tidal power. Solar energy potential is almost unlimited in a tropical country like India. Wind energy is available in abundance, especially in coastal areas and in hilly regions, but both solar and wind energy are not so far utilised in the absence of cost-effective technologies. The non-conventional renewable sources of energy received attention recently. Due importance is also given in the Five Year Plans. It is seen that the share of budgeted outlay on non-conventional renewable sources ranges between 0.1 per cent and 0.4 per cent and it shows consistently an increasing trend.

Biogas is one of the important renewable sources of energy and derived from organic materials like cowdung, night soil, poultry dropping etc,. There are new over 1.8 million family size biogas plants in operation in our country, which provide significant energy. India's wind potential is estimated at about 20000 MW. Wind survey projects covering wind mapping, monitoring and complex terrain projects are under implementation in 22 states and Union Territories. There are 334 winds mapping and 94 wind monitoring stations are operational in the country. As far as solar energy is concerned, on an average India receives 5 kwh per sq.km of Solar Radiant Energy (SRE) for about 300 days per annum. This energy can best supplement the thermal energy requirement in

different sectors of the economy. Solar thermal power is envisaged to be more suitable for arid areas where abundant sunshine is available with other sources of power. It is estimated that around 100 hectares of land in a region like Rajasthan can produce 35 MW of power from solar energy. At present, solar thermal applications have not received a better market because of various subsidies given to the other fuels. Appropriate technology with scale advantage is required in non-conventional energy sector to tap solar, wind and tidel energy.

Energy consumption and crisis

The energy produced by different commercial sources are consumed by various sectors of the economy. Table.6.6 shows the trend in consumption of commercial energy by different sectors. In consumption of energy, industrial sector has been the largest consumer of the commercial energy produced in the country followed by the transport sector. Together they account for over two thirds of commercial energy consumed. However, there has been a marginal fall in their share of the total commercial energy consumption as it is evidenced that their share was as high as 86 per cent in 1953-54 it declined to 81 per cent in 1970-71 and 75 per cent in 1990-91. Agricultural sector has registered sharp increase in the consumption of commercial energy i.e. from 4 per cent to 9 per cent.

Table. 6.6.Sectoral Trends in Consumption of Commercial Energy

(Per cent)

Particular	1953-54	1970-71	1990-91
Household sector	10	14	14
Agriculture	2	4	9
Industrial	40	52	50
Transport	46	29	25
Other	2	1	2

Source: Datt and Sundaram 1997.

During the same period, the share of the household sector in commercial energy consumption increased from 10 per cent to 14 per cent and this is attributed to the fact that increase in population drive the demand for energy. Increasing trend in energy consumption in agricultural sector across periods is due to adoption of modern technologies, farm mechanisation, development of major and minor irrigation projects resulted in increased area under irrigation and cropped area.

Table. 6.7.Percentage Share of Different Fuels in Commercial Energy Consumption

(Percentage)

Particulars	1953-54	1970-71	1990-91
Coal	80	59	39
Oil and gas	17	31	43
Electricity	3	10	18
Total	100.0	100.0	100.0

Also it is observed that the share of coal in the total commercial energy consumption has declined steadily over the years and the share of oil and electricity, however, has steadily increased during the period between 1953-54 and 1990-91. As far as coal consumption is concerned, only the direct consumption of coal in industry, household sector, transport etc., is considered and the use of coal in power generation is ignored. It is important to note that about 65 per cent of the total coal produced in India is used for thermal power generation.

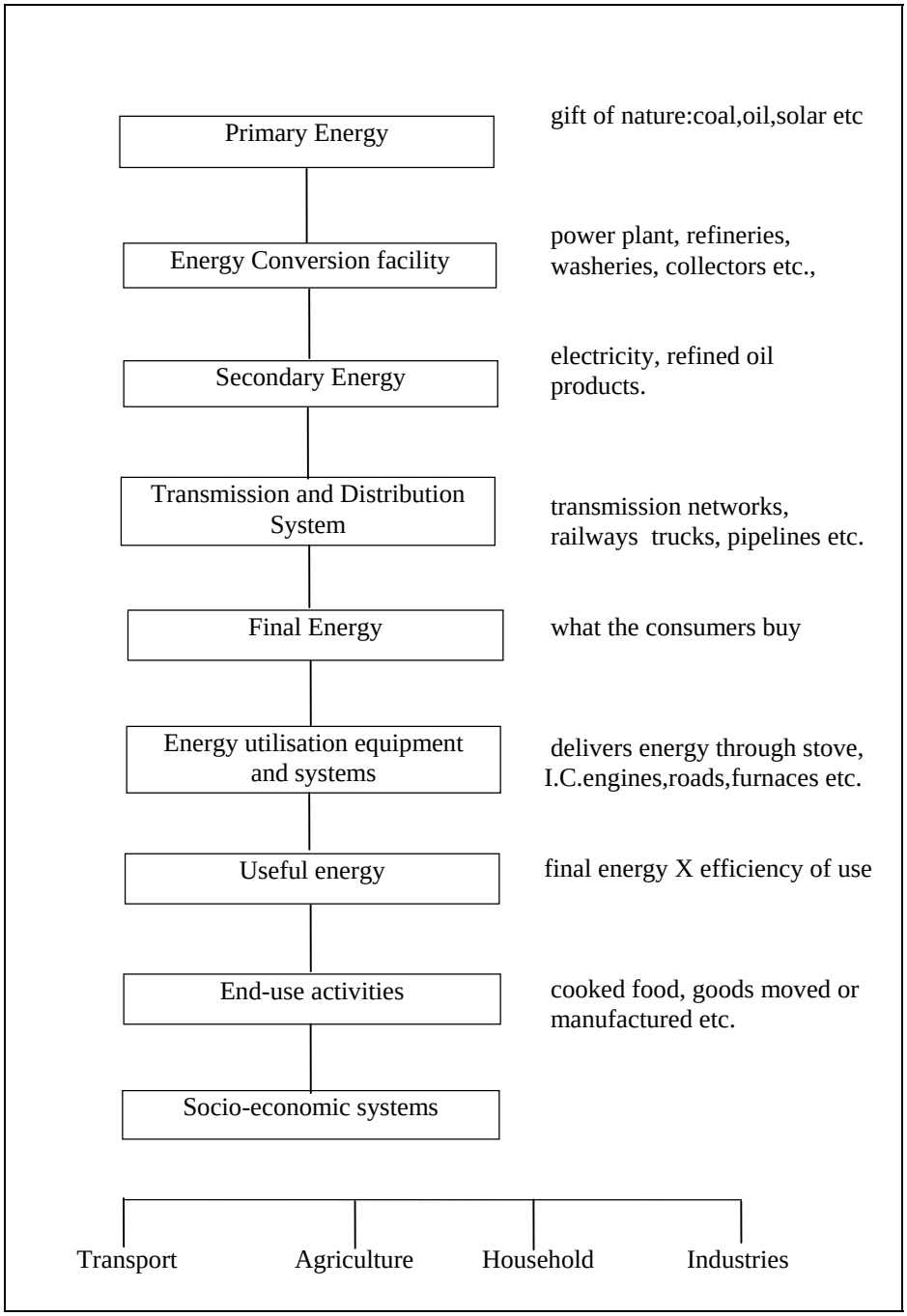
The energy crisis of our country during seventies and eighties is an oil crisis; it is thus a global problem. As far as India is concerned, the energy crisis has peculiar features. India's energy problem is not one of mismatch between demand and supply in oil only. Demand-supply gap is widening in all commercial fuels, because demand for commercial energy has been increasing greatly. For example, during the period between 1953 and 1980, electricity consumption increased by 11 times, oil by 6 times and coal by 2 times. With a higher economic growth, the demand for commercial energy would continue to go up every year.

The increase in production of commercial fuels is not adequate to meet the demand. The consumption of petroleum and oil products exceeded the indigenous production and refining capacity, resulting to country as import dependent. At the same time, though coal industry is able to produce adequately to meet the demand, its performance is not fair on the part of quality. There is also mismatch between demand and supply of electricity and the gap is widening. With the growth and development in industrial and agricultural sector, the demand for power is growing rapidly but on the supply side there are many problems like shortages and constraints in generation and distribution of electric power in the country. By solving these problems in an effective manner, the growth and development of the economy could be hastened. Thus, energy sector should be given highest priority, as it is crucial input for various economic activities.

Energy sector is a crucial sector, which should be treated in a holistic manner so as to achieve many benefits in the economy. It is clear that the power sector facing many problems like financial sickness of State Electricity Boards, transmission and distribution losses and power theft. These problems could be solved by way of empowering the State Electricity Boards in order to improve power-generating capacity and emphasis must be laid on reduction in transmission and distribution losses. Even the privatisation of existing State Electricity Boards can be thought of in a phased manner for effective management of power sector. Though coal sector has shown significant progress in the production, the coal produced is of poor quality. Emphasis needs to be placed on improving the quality and quality of coal production, reduction in the cost of production and encouraging private sector investments in coal industry. The major problem faced by the Hydrocarbon sector is attributed to imports of oil and oil products and this forces our country to be import dependent leading to balance of payment crisis at various level. Also, the domestic production of crude oil is stagnant during recent years. Thus, the policy focus should be directed towards increase oil production, developing conservation technologies and substitutions by other fuels. (Eg.coal). Enough emphasis must be laid on prices of petroleum and petroleum products. In the light of growth and development of different sector of the economy, with the depletion of conventional energy sources, policy focus must also be significant towards the development of non-conventional energy sources, which are relatively abundant in our country. To conclude, issues of energy sector have strong intertemporal dimensions. They involve trade-offs between today and the future. Demand management can solve today's problem. But supply of energy has to be increased to solve the future crisis.

Figure.1

Flow of Energy from Production to Consumption



SOURCE: Parikh, 1980.

Chapter 7

FOREST RESOURCES

Forests are an important natural resource of India. They have a moderating influence against floods and thus they protect the soil against erosion. They provide raw material to a number of important industries, namely, furniture, matches, paper, rayon, construction, training etc.

(I) The total area under forests was 68 million hectares in 1990-91, which was about 22 per cent of the total geographical area.

(ii) Forests in India are mostly owned by states (95%); a small portion is under the ownership of corporate bodies and private individuals. On the basis of legal status forests are classified into (a) reserved (53%), (b) protected (30%) and (c) unclassed (17%) forests. There is concentration of forests in a few stated like Assam, Madhya Pradesh, Orissa and a few Union territories. Northern India is particularly deficient in forests. There is a need to increase forest areas in the entire country as also to develop them in deficient states.

In India, wood and other products serve as a basic raw material for several industries. Wood is needed for paper pulp, newsprint, rayon, furniture, matches, etc. Besides providing raw material for pulp, forests are a source of a number of minor products like bamboo, canes, grasses, essential oils, resins, medicinal plants, lac, gums, tanning materials, dyes, etc. Quite a number of these are valuable foreign exchange earners. State governments receive around Rs. 450 crores annually by way of royalty from major and minor forest products.

India is still short of industrial wood. Forests supply firewood; it is on account of the shortage of firewood; it is on account of the shortage of firewood; cow dung is used as fuel. For both these purposes, area under forests should be extended.

(iii) The contribution of forestry of Gross Domestic Product (at 1970-71 prices) 4 in 1950-51 was Rs. 2,950crores, and it rose to Rs. 3,850 crores in 1970-71 but thereafter, it has shown a decline and was around Rs. 3,310crores in 1991-92. This indicates a negative growth rate in the contribution.

The Problem of deforestation

While the total area under forests is now put as million hectares or 22 per cent of the total geographical area- the National Remote Sensing Agency (NRSA) has indicated that only 36 million hectares have good green cover. The most significant revelation is that the country is losing about 1.3 million hectares of forest cover every year due to extension of cultivation, mining, wood-based industries and finally t indiscriminate felling of trees. To take only one example, annual plantation rate targeted in the Sixth Plan was 400,000 hectares, but the annual average afforestation was only about 110,000 hectares. This means that more than a million hectares of forests are lost every year. The devastation caused to the economy by continued and excessive deforestation is indeed enormous. Deforestation is directly responsible for greater frequency and intensity of floods, soil erosion, heavy siltation of dams built at enormous expense and changes in climatic conditions.

Deforestation has also increased suffering to the landless labourers and marginal and small farmers who have steadily lost their traditional sources of fuel wood and fodder for their cattle. Loss of fuel wood, in turn, has led to the use of cow dung as fuel, resulting in loss of precious organic manure. Continuing deforestation, therefore, has brought us face to face with a major ecological and socio-economic crisis.

Forest Policy, 1952

Appreciating the necessity of developing forests, the Government of India declared its forest policy in 1952. According to this policy, it was decided to raise steadily the area under forests to 100 million hectares or 33 per cent for the country as a whole. The target was to provide green cover over two-thirds of the land area in the hills and mountains. To achieve this goal, it was necessary to secure the long-range development of forest resources on the one hand, and to meet the increasing demand for timber and firewood on the other. The main objectives of forest policy under the Five-Year Plans were (I) to increase the productivity of forests, (ii) to link up forest-development with various forest-based industries; and (iii) to develop forests as a support to rural economy. Keeping these broad guidelines, efforts were directed in the following specific areas:-

Afforestation measures To meet the deficiency of supply of wood in view of the growing demand, three important schemes were undertaken: (I) Plantation of quick growing species; (ii) plantation of economic species (teak, sisso and seamal,etc,); (iii) plantations to be raised under the scheme of rehabilitation of degraded forests. There were various afforestation schemes under state plans and a total area of about 4.5 million hectares was brought under manmade plantations between 1951 and 1991.

Social forestry Recent studies have shown that 25 per cent of the total energy is provided by burning wood, amounting to 155 million tonnes a year. Out of this managed forests provide only 10 million tonnes and the rest comes form trees and plants in villages. If the tread to deplete the present forests without replacing them by new trees continues, we may be faced with a fuel-wood famine in the near future. The social forestry scheme was formulate to tackle this problem. The Government accepted the recommendation of the National Commission on Agriculture, 1976 and agreed to set up social forestry projects on non-forest lands, public lands and on village commons, in order, (i) to increase green coverage, (ii) to produce and supply firewood, fodder, small timber and minor forest produce to the rural population, specially to the landless and other weaker sections, (iii) to produce raw materials for paper, rayon and match industries, (iv) to meet the fuel wood requirements of the urban poor and (v) To create more employment in rural areas through afforestation.

There are three components in social forestry programmes, viz. (a) farm forestry: Farmers are encouraged to plant trees on their own farms with free or subsidised seedlings supplied by the forest department; (b) public woodlots: the forest department undertakes the planting of fast growing trees along roadside, canal banks and other such public lands for the needs of the community; and (c) community woodlots: trees are planted by the communities themselves on community lands to be shared equally by the villages. This is the self-financing component of the social forestry programme.

Social forestry was launched by several states and ambitious programmes were formulated. Districts chronically deficient in fuel wood were selected for raising quick growing fuel wood and fodder species. During the Sixth Plan, for instance, over 9,000 million seedlings were distributed which could cover over 4.5 million hectares. The World Bank and other foreign aid agencies finance many of the social forestry programmes.

Promotion of Methods for increased Production In order to improve utilisation of forest resources, modern tools and equipment tested in advanced countries are used increasingly. Such a step is bound to be more useful in the hilly areas. Forests at high altitudes generally remain unexploited, due to inaccessibility. It is essential that cable cranes be employed and means of transport be developed for the purpose

One of the problems of India's forestry is low productivity. On an average the growing stock per hectare is only 28cu. meters against the world average of 10cu. meter per hectare against the world average of 2.0cu. Metres. A recent estimate has pointed out the possibility of increasing Indian forest produce at the rate of 5cu. metres per hectare,i.e. , ten times the present rate of growth of output, provided the forests are properly stocked with fast growing valuable species and are protected and tended in a scientific manner so as to avoid waste.

Forest Development Corporations To attract institutional finance for forestry development, 17 autonomous Forest Development Corporations have been set up in various states and Union Territories. Their main function are: raising new plantations, developing infrastructure to exploit forest resources through large-scale investment in economically viable projects, logging and marketing timber and minor forest produce.

Forest Resources Survey The Government set up in 1981, an organisation known a "Forest Survey of India" to assess and to periodically monitor the forest resources of the country. The Government has also set up "A Planning Project Formulation Resources Appraisal and Evaluation Cell" in the Forest Division of the Department of Agriculture, in order (a) to guide social forestry programme, (b) to coordinate the activities of the State Development Corporations and to evaluate their projects, and (C) to prepare and negotiate projects for external assistance.

National Wastelands Development Board (NWDB) The Central Government set up NWDB in 1985 to bring 5 million hectares of wasteland per year under fuelwood and fodder plantation. The setting up of this Board was the Government's response to the continuous deforestation in the context of the exploding population on the one side and the tremendous suffering of the weaker sections in the rural areas in their search for fuelwood and fodder, on the other. NWDB works under the overall guidance of the National Land Use and Waste lands Development Council headed by the Prime Minister and attempts to reverse the trend of rapid deforestation, and to conserve the already depleted forests by bringing wastelands under tree cover. This programme of afforestation at the rate of 5 million hectare per year is, of course, ambitious, for it is more than 10 times the rate achieved in the Sixth Plan period. A programme of this dimension can be achieved only if it becomes a people's movement. While announcing the setting up of NWDB in 1985, the then Prime Minister Rajiv Gandhi announced: "We shall develop a people's movement for afforestation".

Plan outlays of Forests

During the Five-Year Plans, the expenditure of forest development has been in the range of 0.5 per cent to 0.6 per cent of the total plan expenditure. Total expenditure on forest during thr First Plan was Rs. 10 crores(0.5 per cent total plan outlay), it was Rs.19 crores during the Second Plan (0.4 per cent), Rs. 46 crores during the Third Plan (0.5 per cent) and Rs. 93 crores during the Fourth Plan (0.6 per cent of total outlay). The Sixth Plan outlay on forests was Rs. 690 crores , which was 40 per cent more than what was spent in the previous 30 years (Rs. 480 crores); but in percentage terms, the Sixth Plan outlay was less than 0.6 per cent of the total Plan outlay. During the Seventh Plan, the allocation for forestry and wild life was raised substantially to Rs. 1.860 crores, that is 1 per cent of the total outlay. Although in absolute terms there has been an increase in plan

outlay on forests but in relative terms it was more or less insignificant. Expert feels that this allocation has been insufficient for forest development. This explains, to a considerable extent, as to why the contribution of forestry to gross domestic product has been so low.

New Forest Policy, 1988

The 1952 forest policy had failed to stop the serious depletion of forest wealth over the years. It became imperative to evolve a new strategy of forest conservation. The important features of new forest policy are:

Role of tribals in forests recognised: The new 1988 forest policy removes many anti people statements of earlier documents and recognises the symbiotic relationship between the tribal people and forests. It seeks to ensure that communities living within and around forest areas, especially the tribal should be able to get their domestic requirement of fuel wood, fodder, minor forest produce and timber from forests. The new forest policy enunciates that all agencies responsible for forest management, including forest development corporations should associate tribal people closely in the protection, regeneration and development of forests.

Depletion of forest area and the target for green cover: The new forest policy begins by stating that forests have been depleted owing to fuel, fodder and timber needs and transfer of land for non-forest uses and for raising revenue. It clearly recognises the failure of the state to preserve forests and control timber smugglers and constructors. The new policy reiterates that green cover should be extended to over two thirds of the land area in the hills and mountains and that the total forest area in the country should be raised to 100 million hectares or 33 per cent of the total geographical area in the country.

Discouragement to forest based industries: The new forest policy states that forest based industries must get their raw materials from wood raised through farm forestry, and that no forest based enterprises except at the village or cottage level would be permitted in the future, unless it has been first cleared, after a careful study of the availability of raw materials.

The new forest policy asserts that forest based industries will, no longer, be allowed to plunder the country's forests. It says that the practice of supplying forest produce to industry at concessional rates would cease. In an earlier draft of the new policy the forest departments were sought to be given the permission to lease wastelands to industry for growing industrial raw materials. The new policy, however, states categorically that forestland will not be made available for lease to industry. The industry is now advised to motivate farmers to grow raw materials by supplying them with credit, technical advice and other measures.

End the system of private forest contractors: The new policy advocates an end to the system of contractors working the forests. The contractors will be replaced by institutions such as tribal cooperatives, government corporations etc.,. It is a well-known fact that private contractors have exploited ruthlessly the simple and ignorant forest dwellers. But the tribal development cooperatives and other official agencies had also failed miserably and have become sources of exploitation. Even then, the new forest policy advocates the distribution of minor forest produce through state-run depots.

Forestland not to be diverted to no forest uses: The forest department used to assign forestland to an individual or non-government agency for the purpose of reforestation. But it is a cognisable offence to put forest land into non-forest uses which have been defined

as cultivation of tea, coffee, spices, rubber, palms, oil-bearing plants, horticultural crops or medicinal plants.

The government has generally suggested alternatives to industrial timber, railways sleepers and fuel wood. The new policy suggests that India should import timber from other countries.

Critical appraisal of New Forest Policy

Even though the new forest policy has been hailed as a blueprint for restoring the green cover over one-third of the country's land, it says nothing that has not been said by the forest policy of 1952. The target fixed by the policy of 1988 is to have 100 million hectares under forestry, and the strategy to be used is to provide green cover over two-thirds of the land area in the hills and mountains-the target and the strategy were exactly the same as those fixed 36 years ago.

The reasons behind the destruction of forests are well known. It was because of the industrial orientation that the felling of trees for industrial and commercial purposes became extensive and the pace of deforestation gets intensified after independence. The new forest policy is also bound to fail in the face of uncontrolled expansion of population and regular encroachments on forest land, mindless construction of multipurpose irrigation projects destroying prim forests, extension of mining and construction of townships and above all illegal felling of trees, all these directly result in rapid deforestation and all these measures are likely to continue.

Of all the environmental problems facing the country, the problem of deforestation has received the maximum attention from the Government and the public but ironically, government policies on afforestation have attracted the greatest public criticism.

Chapter 8

FISHERIES RESOURCES

Fisheries play an important role in the Indian economy, generating employment for a large coastal population-- about 1.8 million fishermen draw their livelihood from fisheries, though they generally live on the verge of extreme poverty. Fisheries help in raising nutritional levels, augmenting food supply and earning foreign exchange. The contribution of the fisheries sector to net domestic product (at current press) has shown a fourfold increase between 1985 and 1994 -- increase from Rs. 1,480 crore to Rs. 6,750 crore.

Broadly speaking, fishery resources of India are either inland or marine. The principle riversand their tributaries, canals, ponds, lakes, reservoirs comprise the inland fisheries. The rivers extend over about 17,000 miles, and other subsidiary water channels comprise 70,000 miles. The marine resource comprises the two wide arms of the Indian Ocean and a large number of gulf and bays along the coast. In 1951 total fish production was about 0.8 million tonnes. This has increased to 4.8 million tonnes. This has increased to 4.8 million tonnes in 1994-95 of which, about 2.1 million tonnes came from marine sources. Only about 5 per cent of fish production is exported bringing in foreign exchange earnings of Rs. 2,500 crores(in 1993-94) and Rs.3,580 crores in 1994-95."

The Five year plans assign high priority to the development of fisheries because of the necessity to raise the nutritional levels of protein defiicient Indian diet and to earn much needed foreign exchange, The Fifth Plan, for instance, allocated Rs. 160 crores for fishery development. In order to give a fillip to deep-sea fishing, the Goverment planned to introduce 200 deep-sea fishing vessels during the Fifth Plan. During the Sixth Plan, the fisheries programme gave special attention to family-based labour-intensive inland and brackish water fisheries and improving the harvesting from seas by stimulating the growth of country boats, mechanised boats and deep-sea trawlers.

Development of Fisheries

Despite the vast fishery resources, the production of fish in India are far from adequate. India produces only 9 per cent of total supply of fish in Asia, whereas Japan contributed to the extent of 43 per cent and china coming next, to about 18 per cent. The importance of developing fishery resources lies in the fact that they can act as substitute to our land resources. However, we have not exploited our marine resources fully. The Indian Ocean Expedition has estimated that only 1 to 8 per cent of the fish available along the Easter and Western coasts are being caught at present. If modern methods of catching are employed, it is possible to increase the fish catch by 10 times i.e., from the present 4.7 million tonnes from the sea to over 40 million tonnes per year. This indeed would make a tremendous impact on nutritional standards of the people and on our foreign exchange earnings.

More over, the application of fish culture can improve the supply of fish. The Tungabhadra Dam project has demonstrated that with the use of fish culture methods, within a few years, supplies of fish could be increased from 700 pounds 3,00 ,000 pounds.

Marine fisheries

High priority is being given continuously to the development of fisheries in view of the extended jurisdiction over 320km of sea from the coastline. The programme of mechanisation of fishing crafts is being followed vigorously. The Government of India is providing subsidy up to 33 per cent of the cost of vessels and is permitting charter of foreign fishing vessels and joint ventures. To exploit marine fisheries resources, landing and berthing facilities for fishing crafts are being provided at various major and minor ports. Fishing harbours capable of handling small and medium size fishing vessels have been developed at the minor ports. For the operation of medium and large size deep sea fishing vessels, fishing harbours have been developed at the major ports.

An Integrated Fisheries Project has been in operation in Cochin and the major activities of this Project include: (a) experimental fishing; (b) production and marketing of diversified fish products; (c) setting up of modern aluminium canning plant, and (d) training of personnel for fisheries industry.

Inland fisheries

While considerable interest is being shown to the development of marine fisheries, inland fisheries have not been neglected altogether. During the Fifth Plan, the Central Government sponsored Fish Farmers Development Agencies (FFDA's) to popularise fish farming in tanks and ponds and brackish water Fish framer's development Agencies (BFADs) for development of trackish water aquaculture. There are 147 FFDAs functioning in 17 states. These agencies have so far brought more than 100,000 hectares of water area under intensive fish culture and the fish yield has been raised from 50kgs per hectares in the 1970s to about 150kg per hectare now. The Government of India is also implementing a "Shrimp and Fish culture Project" with World Bank assistance for development of shrimp culture in the states of AP, Oridda and West Bengal and for increasing inland fish production in Bihar and U.P.

While there has been remarkable improvement in inland fisheries, there are some disturbing trends as well. In the first place, there is danger to riverine fisheries because of growing river pollution. Discharge of untreated effluents from the industrial units located near the rivers and of urban sullage destroys fish in thousands. Besides, the construction of dams, weirs and barrages prevents the free migration of fish to their usual breeding and feeding grounds and thus adversely affects the stock of fish in rivers. Accordingly, fisher folk who have depended on rivers and lakes for their livelihood for centuries have been forced to give up their hereditary occupation and become landless in rural areas or migrate to cities and towns in search of employment. This indeed, is an important consequence of new technology and economic development.

India has a vast potential of fishing resources comprising 2 million sq.kms of Exclusive Economic Zone for deep-sea fishing, 7,520kms of coastline 29,000 kms of rivers, 1.7 million hectares of reservoirs, nearly 1 million hectares of brackish water area and 0.8 million hectares of tanks and ponds for inland and marine fish production.

Chapter 9

LIVESTOCK RESOURCES

Livestock plays a dominant role in Indian economy. It is of great use for the purpose of cultivation, as well as transport and the production of milk is more or less in the nature of a by product to the Indian cultivators.

Indian possesses the largest number of cattle of any country in the world. Of the world's cattle population of 30,846 lakhs, India's share has been estimated at 1,760 lakhs. Of the cattle population, nearly 50 per cent are unproductive. Of the cows, only 20 million give milk and 25 million are dry ones. The young stock below 3 years is 50 million. Of the buffaloes, only 13 million yield milk and 22 million are dry and 18 million are young stock. The yield of milk per cow in India is the lowest in the world (only 361 lbs. per year and for buffalo 790lbs. per year). In Netherlands and Belgium, the yield of milk per cow per year is 8,371 lbs. and 7,426lbs respectively.

Hence the question arises: Does India needs such a huge cattle population? Quite a substantial percentage of our cattle population is surplus. They have become more of liability than of asset to the agricultural economy and the Hindu religious faith does not allow extermination of the useless lot.

In spite of the large number, the efficiency, performance and contribution of livestock towards agricultural production and increase in national income are deplorable low in India. In our country, nearly one-half of national income is accounted by agriculture, and the contribution of livestock to the gross agricultural income is barely 15 per cent. In the case of foreign countries, particularly Denmark, Sweden, U.K. and West Germany livestock income would constitute the major share of the gross agricultural income of the countries. The Table9.1 shows the contribution of livestock towards agricultural and national income of some selected countries:

Table.9.1. Contribution of livestock to agricultural income in some countries

Country	Percentage of agricultural income of National income	Percentage of Livestock income to Gross Agricultural income
Denmark	16	83
Sweden	6	80
United Kingdom	4	78
West Germany	8	71
india	47	15

Though the environmental conditions are entirely different in the foreign countries enabling them to have quality stock with excellent productivity, considering the enormity of livestock in India, the per centage contribution is very meagre. This is mainly due to the non-availability of adequate fodder to cattle in India. Livestock requires large land for grazing and sustenance and in our country the grazing land available for livestock is too small.

Objectives of Livestock sector

(1) Livestock production and dairying programmes have to be viewed as an effective instrument of social change through supplementing the income of the people in the rural sector.

(ii) It should be a source of employment to the weaker sections of the people in the rural areas.

(iii) Special emphasis will be laid on projects for increasing the productivity of various species of livestock through genetic improvement and better health cover.

(iv) Adequate attention will be given to feed and fodder production, integrating these into mixed farming system, crop rotation and agro-forestry programmes.

Chapter 10

RESOURCE DEGRADATION

Mindless and ruthless exploitation of natural resources led to degradation of the country's natural resources. Rapid economic development is turning India into a vast wasteland. There are three types of resources viz., land, water, and energy. Degradation of these resources in general and land in particular occurs through desertification, erosion, deforestation, waterlogging, salinity, chemical degradation, uncontrolled shifting cultivation, flooding and natural calamities.

Land Degradation and Desertification

Land degradation can be defined as a reduction in the soil's capacity to produce in terms of quantity, quality, goods, and services. Several other concepts are important to this definition:

- Sustainability or the ability of the land to continue to produce indefinitely;
- Resilience or that quality of a resource that makes it sustainable or resistant to degradation; and
- Carrying capacity or the number of people and animals the land can normally support without being significantly stressed.

Land degradation lowers the productive potential of land resources, affecting soils, water, forests and grasslands. If unchecked, it can lead to irreversible loss of the natural resources on which production depends. The severity of two kinds of degradation, soil erosion and rangeland degradation (desertification), have sometimes been subject to exaggerated claims. Both are indeed widespread and serious, but satisfactory measurements of their effects have yet to be made.

Soil fertility decline is more widespread than formerly realized, leading to reduce crop yields and lowered responses to fertilizers. About 5% of the agricultural land in developing countries has been lost by degradation, and productivity has been appreciably reduced on a further 25%. Some 10% of irrigated land is severely Stalinized. In the semi-arid zone where water is most needed, the limits to water availability has been reached. Over the past 10 years, forest cover in tropical regions has been lost at 0.8% a year, and there is no sign yet that the rate of clearance has been checked.

The direct causes of degradation are a combination of natural hazards with unsuitable management practices. Underlying these are economic and social reasons, fundamentally arising from poverty and land shortage. There is a causal link between population increase, land shortage, poverty and land degradation. Tentative economic analysis suggests that degradation is costing developing countries between 5% and 10% of their agricultural sector production. This affects the people through reduced food supplies, lower incomes, greater risk, and increased landlessness.

Landscapes throughout the world undergo transformation processes that include some form of natural degradation, but these processes are usually compensated for and counterbalanced by nature's inherent recovery ability. Net degradation occurs whenever the degradation processes significantly exceed nature's restorative capacity.

Desertification is generally viewed as an advanced stage of land degradation. At the United Nations Conference on Desertification (**UNCOD**), desertification was defined as a "diminution or destruction of the biological potential of the land which can lead ultimately to desert-like conditions" (1978).

The Nature and Causes of Land Degradation and Desertification

Although the concept of land degradation is well established, the concept of desertification is still obscure. The lack of a generally accepted definition helps explain the lack of consensus on the nature and causes of desertification processes. The *World Resources 1992-1993* documents the types and causes of soil degradation. The types include water and wind erosion and physical and chemical deterioration; the causes include deforestation, overexploitation, overgrazing, and other agricultural activities.

Dregne (1986) discusses three key desertification processes in arid lands:

- Deterioration of vegetative cover due to overgrazing, wood cutting, and burning;
- Wind and water erosion resulting from improper land management; and
- Salinization due to improper use of irrigation water.

Desertification

The phenomenon known as desertification has received widespread attention recently, as witness the creation of the United Nations Conference on Desertification in Nairobi in 1977, mainly as a result of the impact of extended drought in the West African Sahel in the early 1970s. It described desertification as:

"The diminution or destruction of the biological potential of the land, (which) can lead ultimately to desert-like conditions. It is an aspect of the widespread deterioration of ecosystems, and has diminished or destroyed the biological potential, i.e. plant and animal production, for multiple use purposes at a time when increased productivity is needed to support growing populations in quest of development.

Desertification is of particular interest to climatologists in their attempts to understand climate variation and change on both short and long time scales. With increasing pressure on governmental decision-makers to allow populations to move into the climatically marginal areas, the implications of natural variations in climate have become even more important in decisions relating to the use by society of its land in these desertification-prone regions. One can easily assert that there will always be climatic deserts. However, man-induced extensions of these deserts or the creation of desert-like conditions in areas where they had not existed can and must be avoided.

Desertification: What is it?

Some researchers consider desertification to be *a process* of change, while others view it as the *end result* of a process of change. This distinction underlies one of the main disagreements about what constitutes desertification. *Desertification-as-process has generally been viewed as a series of incremental changes in biological productivity in arid, semi-arid, and subhumid ecosystems.* It can encompass such changes as a decline in yield of the same crop or, more drastically, the replacement of one vegetative species by another maybe equally productive or equally useful, or even a decrease in the density of the existing vegetative cover. Desertification-as-event is the creation of desert-like conditions as the end result of a process of change. In fact, these two views represent different aspects of a broader concept of desertification. Thus, seemingly different statements such as "the creation of desert-like conditions in areas once green", "encroachment of desert-like conditions", "the intensification of desert-like conditions", as

well as less drastic projections like "changes in soils and in climate" or "the land becoming less fit for range and crops", can be encompassed by the concept of desertification.

What is changed?

Different definitions focus on changes in soil (e.g. salinization), or vegetation (e.g. reduced density of biomass), or water (e.g. waterlogging), or air (e.g. increased albedo). Most of them, regardless of primary emphasis, also describe changes in biological productivity, with comments related to the type, density, and value of vegetation.

Changes in the density of the vegetative cover constitute an important factor acknowledged by many authors in their definitions of desertification. As density decreases, for example, the risks of wind erosion, water erosion and the adverse effect of increased solar radiation on bare soils are increased dramatically. Surface albedo (reflectivity), also enhanced by a reduction in the vegetative cover, is a major contributor to desertification processes.

As a final comment on what desertification is, it is important to note that disciplinary and institutional biases may appear in any given definition of the phenomenon. For example, a meteorological bias might require for the use of the term "desertification" that a change take place in the meteorological parameters of a given region, so that they become similar to those for a desert region (e.g. high evaporation rates, aridity, increased rainfall intensity, and so on).

Causes of Desertification

Climate

References to climate in these definitions relate either to climate variability, climate change, or drought. *Climate variability* a (term that is usually itself undefined in these definitions) seems to refer to the natural fluctuations that appear in the statistics representing the state of the atmosphere for a designated period of time, usually of the order of months to decades. Fluctuations may occur in any or all of the atmospheric variables (such as precipitation, temperature, wind speed and direction, evaporation, etc.). A result of those fluctuations may be the alteration of an ecosystem, and this could eventually affect societal activities that have been developed to exploit the productivity of that ecosystem.

It is important to note that during the annual dry season the characteristics of the atmosphere in an arid or semiarid area are like that of a desert-like region (low precipitation, high evaporation, high solar radiation, etc.) and if improper use of the land occurs during this period, degradation results. Thus, short-term fluctuations in climatic factors as well as seasonal dry periods, when combined with improper land-use practices, can give the appearance of the impact of a climate change when none may have occurred at all.

Human activities

Cultivation, herding and wood gathering practices, as well as the use of technology, have all been cited in the definitions as major causes of, and contributors to, the desertification process in arid, semi-arid and subhumid areas. *Cultivation practices* that can lead to desertification include land-clearing practices, cultivation of marginal climatic regions,

cultivation of poor soils, and inappropriate cultivation tactics such as reduced fallow time, improper tillage, drainage, and water use. For example, areas that might support agriculture on a short-term basis may be unable to do so on a long-term sustained basis. Even areas that are considered suitable for cultivation may become degraded if they are managed in a way that is inappropriate to the ecological and climatic setting.

Rangeland use that can lead to desertification includes excessively large herds for existing range conditions (leading to overgrazing and trampling) and herd concentration around human settlements and watering points. Government policies towards their pastoral populations can also indirectly lead to desertification by, for example, not pursuing policies that encourage herders to cull their herds, by putting a floor on grain prices and a ceiling on prices that pastoralists might receive for their livestock, and so forth.

Gathering fuel wood by itself or in combination with overgrazing or inappropriate cultivation practices creates conditions that expose the land to existing "otherwise benign" meteorological factors (such as wind, evaporation, precipitation runoff, solar radiation on bare soil, etc.), thereby contributing to desertification.

The *use of technology* in arid, semi-arid and sub-humid environments is the result of the policy-makers' desire for economic development. Thus, deep wells, irrigation and cash-crop schemes, even the reduction of livestock diseases such as sleeping sickness, each in its own way, can increase the risk of desertification processes in an area. It has been shown that desertification can result from road building, industrial construction, geological surveys, ore mining, settlement construction, irrigation facilities, and motor transport (Rozanov, 1977).

Land Degradation and soil erosion

According to the Ministry of Agriculture, GOI, soil erosion and land degradation have assumed serious proportions. Nearly 175 million hectares or 53 per cent of the total land area in India is suffering from serious degradation. Area subject to water and wind erosion amounts to 141 million hectares and is degraded for various causes accounted for 34 million hectares. Area degraded through special problems includes: waterlogged area 6 million hectares, alkaline soil: 2.5 million hectares, saline soil: 5.5. Million hectares etc.,

Soil erosion takes place when surface soil is washed away through excessive rains and floods. It occurs because of indiscriminate felling of trees and conversion of forests into cultivated land, uncontrolled grazing of by cattle and wrong method of cultivation.

Problem of overgrazing and resource degradation

The effects of hapazard grazing on the resorce potential are alarming. Resource degradation due to overgrazing has led to desert like conditions. Besides, depletion of vegetative cover, overgrazing is hardening the soil preventing forest regeneration and causing soil erosion. In addition to resource degradation, there is growing hostility from farmers against graziers who are generally nomads.

Deforestation and land degradation

Deforestation is one of the major causes of resource degradation. It is evidenced that during the period between 1951 and 1971, over 70 per cent of forest area was lost to agriculture and another 17 per cent was lost to river valley projects, industries and roads

and communications. The process of deforestation has continued till today at the current rate of 1.3 to 1.5 million hectares every year.

The progressive depletion of the country's forest wealth is literally driving the country towards an ecological collapse. Increasing floods, soil erosion, and heavy siltation of dams constructed at enormous cost, changes in the microclimate are the consequences of deforestation. Floods are becoming too frequent and their intensity and heavy damage to life and property are increasing over the years. The new Forest Policy, 1988 is a weak attempt to reverse the trend of ruthless destruction of forests and promote regeneration and conservation.

Ground Water Resources Degradation

The world's fresh water resources face an unprecedented crisis. Water abstraction greatly exceeds its renewal and demand is likely to increase as the world's population grows. At the same time, usable stocks are being polluted as urban areas expand and agriculture intensifies, and the marginal cost of supplying water increases. This research aimed to develop a better conceptual and practical understanding of groundwater resource (GWR) degradation, and the patterns of relationships governing its causation, impact and management in different socio-economic circumstances particularly in developing countries.

Groundwater degradation takes three forms: *stock depletion*, *contamination*, and secondary problems such as *saline intrusion and land subsidence*. Serious degradation in one or more of these forms was found in eight of the ten case studies. The problem is worsening where natural recharge is low, even though abstraction may not be increasing. Fossil water is particularly liable to non-sustainable exploitation as no effective replenishment occurs.

The case studies demonstrated a number of common effects of degradation. These include growing water scarcity, narrowing usage options, increased competition between users and usage, rising replacement cost, and emerging social conflict. Degradation leads to trade-offs over time (between present and future users) and space (between different contemporary users). Water authorities seldom recognise these problems and the full opportunity cost of water was in no case signalled to consumers. However, a call for economic pricing generally has little practical relevance in the short to medium term because of the absence of institutional mechanisms for water charging, making transaction costs unacceptably high.

Degradation is greatly influenced by institutional context. Open access systems were found to be particularly conducive to over-exploitation but degradation is occurring even where abstraction is closely controlled by the state. There is commonly little or no policy awareness of advancing GWR degradation and problems may not be seriously addressed until the economic or social consequences have become impossible to ignore. Demand management measures, including command and control policies, economic instruments, and awareness building will be increasingly necessary as water scarcity grows.

Policy measures

The following policy measures could be taken up to solve the problem of resource degradation in the country.

- Developing a strong database for monitoring the process of resource degradation like soil erosion, desertification etc. This will help to design appropriate measures to solve the problem of resource degradation.
- Grazing land development in arid and semi-arid regions
- Rehabilitation of forests and afforestation in wastelands
- Extension of cultivated areas
- Relocation of freshwater dependent industries
- Watershed development

Chapter 11

ENVIRONMENTAL POLLUTION

Environmental Pollution may be defined as the unfavourable alteration of our surroundings, wholly or largely as a by products of man's actions, through direct or indirect effects of changes in energy patterns, radiation levels, chemical and physical constitution and abundance of organisms. These changes may affect man directly through his supplies of water and of agricultural and other biological products, his physical objects or possessions, or his opportunities for recreation and appreciation of nature. In simple words it relates to how people pollutes their environment, which was pure, virgin and basically quite hospital for them.

Meaning of pollution

Since almost no substance exists in a pure state, the real meaning of Pollution is only a relative concept. A substance is said to be polluted only when the impurities rise above a certain level that it becomes dangerous and harmful. So pollution may be defined as the addition to air, water or any material that is usually not found or that is in excess of normal quantity.

Types of Pollution

Pollution is classified by different means:

According to the environment in which it occurs as air,water,soil etc., According to the type of pollutant as lead, mercury, carbon dioxide, solid waste, noise, biocide, heat, etc. and according to its origin as natural or artificial.

In general classification, the types of pollution fall on the following categories

1. Air pollution 2. Water pollution 3. Solid waste pollution 4. land pollution 5. Marine pollution 6. Noise pollution 7. Radiation pollution 8. Thermal pollution

These pollution are discussed in detail at appropriate places.

Effects of Pollution

Pollution leaves an dangerous effect on the biosphere, of which many have been identified even though there have been probably many others yet to be discovered.

Pollution and Plants

Agricultural and horticultural plants, which feed the mankind and animals, are affected by pollution. The characteristic types of injury-produced photochemical smog have become severe in some parts of the world that it is essentially impossible to grow orchids, spinach, lettuce, Swiss chard and other leafy vegetables. Other air pollutants having severe effects on vegetation include sulphur oxides (from copper and lead smelters) and hydrogen fluoride (from fertilizer manufacturing). Even when pollution levels have been not high enough to produce noticeable injury, retardation of growth may occur. As some plants have been likely to be more sensitive to pollutants, whether it be an air or water pollutant or radiation, there may occur complex changes in the plant ecosystem, having effects on one species leading to effects on others. Sometimes the undesirable effect of

a pollutant has been the increase in plant life, as when the introduction of plant nutrients such as phosphorus, nitrogen and carbon give rise to algal blooms in water bodies.

Pollution and animals

Air pollutants are known to produce eye and respiratory irritation in animals as well as humans. Mankind has even made use of the sensitivity of some animals to certain pollutants; an example is the use of canaries to detect poisonous gases in coalmines as well as nerve gas near trains that are carrying it. Water pollutants can also endanger aquatic life and every year millions of fishes are reported killed by municipal and industrial wastes in the United States. Sewage, toxic chemicals and disease causing organisms can also make water unfit for use by farm animals. There are some types of pollution known to have adverse effects on animals at levels that do not appear to affect human health. Thermal pollution the excess heating of water in rivers or lakes can kill fish and pesticide levels in many species of birds have reduced their reproduction rates.

Pollution and mankind

Human beings are probably the most concerned about the direct effects of pollutants upon their own health, even though these are not necessarily the most dangerous in the long run. In determining the levels that are toxic to humans, we are generally faced with the following problems. Sufficiently high levels are toxic or even lethal to everybody, although there is a wide range of sensitivities among the population. For example, tartar emetic (antimony potassium tartrate) can be lethal at doses as low as130mg, but some persons have survived doses as high as 15g. On the other hand, sufficiently low doses appear to have no toxicological effect. One possible explanation, however, is that effects are occurring but that experimental techniques are not sophisticated enough to detect them at low doses. It is well known that the effects of low levels of exposure are sometimes not apparent until many years. Asbestos is known to produce increased mortality from lung cancer and asbestosis (severe scarring of the lungs by asbestos fibers) among asbestos workers but these effects takes 20 to 30 years to show up. There is growing evidence that many chronic diseases (such as asthma, emphysema and bronchitis) are environmentally induced and results from long term exposures to levels of various substances too low to produce acute effects.

Many chemicals are therapeutic drugs at lower doses but toxic at certain levels, the difference between the two doses being very narrow. The emetic dose of tartar emetic is 30mg, which is dangerously close to toxic, although there is no danger only if vomiting occurs. The therapeutic value of drugs has been intimately connected with their toxicity and a judgment is always necessary as to whether or not the benefits out weigh the dangers.

It is obvious that many diseases are waterborne and that there frequency can be checked dramatically through sanitation of public and private water supplies. Still, the drinking water of most of the population in the developing countries is considerably less safe than that of the develop nations due to inadequacies in public health programmes.

Pollution and Structural Materials

Pollutants are known to accelerate the deterioration of materials of construction. Air pollutants, particularly so2 gas that is converted into sulphuric acid in the atmosphere, can corrode metals and building materials, increasing the frequency of maintenance. Water pollutants, like suspended particles or dissolved inorganic compounds, can also adversely affect industrial equipment and bridges. With the advent of supersonic jets

capable of producing sonic booms with super pressures (intense noise) of over 100N/m2 can damage even the buildings.

In many cases the combined effects of two or more pollutants are more severe or even qualitatively different from their individual's effects. Numerous studies have shown that some type of particulate matter, such as aerosols of soluble salts of iron(ferrous), manganese and vanadium, can increase the toxicity of sulphur dioxide. Such an increase in toxicity is usually referred as potentiation. Sometimes the combined effects of two pollutants are less severe than their individual effects and this situation is referred as antagonism. Cyanides in industrial wastes are quite poisonous to aquatic life. In the presence of zinc or cadmium they are extremely poisonous (Synergism), apparently due to the formation of complexes. The occurrence of synergistic effects makes it difficult to study the effects of pollution since so many different pollutants are present in the environment and this makes it hard to predict the effects that might take place when certain air or water quality standards are met.

Global effects of pollution

The most disastrous manifestation of pollution has been that man has now become a major factor in several of the great biogeochemical cycles and may be causing irreversible change without realizing it. These biogeochemical cycles are the circulation of various elements through the biosphere, the hydrosphere and the lithosphere. Since the industrial revolution there is subtle but significant changes in the biosphere. These changes have been accelerated in recent years, so that in the momentary span of less than a hundred years many forms of life have the threat of extinction. Besides, the welfare of man himself is in jeopardy. The Red Data Book of the IUCN has given a list of birds and mammals alone, no less than 600 endangered species. The world's leading botanists have warned that nearly 15000 plant species are dangerously rare or going to be extinct and an additional 40000 species could be lost before the middle of the next century. This could be an indication of a deteriorating environment that influences man as well.

Air Pollution

Air pollution may be defined in many ways. In simple terms it can be defined as any ambient condition in which substances are present at concentrations high enough above their normal levels to produce measurable effects.

Bureau of India Standards defines air pollution as the presence in ambient atmosphere of substances, generally resulting from the activity of man, in sufficient concentration present for a sufficient time and under circumstances to interfere significantly with comfort, health or welfare of persons or with full use or enjoyment of property. Air pollution is defined in the Air (Prevention and Control of Pollution) Act 1981as the presence in the atmosphere of any air pollutant which in turn is defined as any solid, liquid or gaseous substance present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment.

Sources of Air Pollution

A source of air pollution is a point or place from where pollutants are discharged into air. The sources of air pollution can be classified as (i) natural sources and (ii) man made sources or artificial sources.

Natural sources include

- Volcanoes which, when erupt, emit huge quantities of particulate matter and gases like sulphur dioxide, hydrogen sulphide and methane.

- Forest fires: It creates smoke, unburned hydrocarbons, carbon monoxide, sulphur dioxide and oxides of nitrogen

- Dent Storms: The soil particulates, which are, transported to far away places by wind causes heavy damage due to abrasive action.

- Oceans: They continuously emit aerosols into the atmosphere in the form of salt particles, which are corrosive to metals and paints.

- Vegetation: Plants produce hydrocarbons. Also, air borne pollen can cause severe respiratory problems in some people.

- Radio Active Materials: The radio active materials present in the soil are exposed to the atmosphere pose a threat to the environment.

Artificial or man-made sources are the emissions from numerous industrial enterprises and automobiles. These pollutants are present in the air in gaseous form as well as in the form of particles.

Air Pollution Control

Having known the several ill effects of air pollution it is acceptable that the problem now we face quite graves some. Immediate steps are to be taken to arrest this monster. There are several control techniques of air pollution. Before dealing with them it is necessary to understand how to prevent it. There are some techniques though which pollution can be prevented:

Process change

Changing operating procedure for an existing process or substitution of a completely different process can do this. The chemical and petroleum refining industries have introduced many changes in processing method to control air pollution.

Changing raw materials

The raw materials may contain non-essential ingredients, which serve as pollution sources. Such ingredients can be removed prior to processing. For example sulphur is one of the principle toxic but non-essential component, which may be present in organic fuels and pollutes the environment around thermal power stations. It can be removed through proper processing.

Alternate Fuels

Less pollution fuels can be used in place of fuels which cause considerable air pollution.

Good house keeping

In the industries it will help reducing air pollution

Use of tall stacks for dilution

This will help to dispose pollutant and to prevent smoke from reentering the building where it is discharged.

Considering the point of control there are several techniques both for particulate pollutant and gaseous pollutants.

Water Pollution

Water is one of the basic requirements of living organisms of the earth. Without it all life ceases. Unfortunately we pollute water in all possible means. The problem gets complicated because every use to which water has been put- washing, irrigation, flushing away wastes, and cooling, making paper etc has been adding something to the water.

Water pollution refers to the addition to water of an excess of material (or heat) that is harmful to humans, animals, or desirable aquatic life, or otherwise causes significant departures from the normal activities of various living communities in or near bodies of water. Water pollution may also be defined as a natural or induced change in the quality of water which renders it unusable or dangerous as regards food, human and animal health, industry, agriculture, fishing or leisure pursuits.

Sources Of Water Pollution

The major sources of water pollution could be classified as domestic, industrial, agricultural, and shipping waste waters.

Domestic Water Pollution

It includes wastewater from homes and commercial establishments. Domestic waste arises from many small sources spread over a fairly wide area but is transmitted by sewers to a municipal waste treatment plant.

Industrial Waste Pollution

This occurs in amounts in specific locations, making collection and treatment fairly simple to accomplish. There are waste-using factories, which are discharging wastes with a total BOD load about three to four times as large as the load from the severed population. Only about 7 or 8% of industrial wastewaters have been disposed of in municipal sewer but, as mentioned above, they constitute about half the total municipal load.

Most of the Indian rivers and fresh-water streams are seriously polluted by industrial wastes of effluents which come along waste waters of different industries such as petrochemical complexes; fertilizers factories; oil refineries; pulp, paper, textile, sugar and steel mills,tanneries, distilleries, coal washeries, synthetic material plants for drugs, fibres, rubber, plastics, etc. The industrial wastes of these industries and mills include metals (copper,zinc, lead, mercury etc.) , Detergents, petroleum, acids, alkalies, phenols, carbamates, alcohols, cyanide, arsenic, chlorine and many other inorganic and organic toxicants. All of the chemicals of industrial wastes have been toxic to animals and may bring about death or sublethal pathology of the liver, kidneys, reproductive systems, respiratory system, or nervous systems in both invertebrate and vertebrate aquatic animals. Chlorine, which is added to water to control growth of algae and bacteria in the

cooling system of power station, may persist in streams to cause mortality of plankton and fish.

Mercury like other heavy metals such as lead and cadmium has cropped up as a toxic agent of serious nature. Mercury, a by-product of the production of vinyl chloride, is used in many chemicals industries and is also a by-product of some incinerators, power plants, laboratories and even hospitals. This mercury poisoning produced a crippling and often fatal disease called Minamata disease. Initial symptoms of Minamata disease included numbness of the limbs, lips and tongue, impairment of motor control, deafness, and blurring of vision. Cellular degeneration occurred in the cerebellum, mid brain, and cerebral cortex and this led to spasticity, figidity,stupor and coma.

In India all the 14 major rivers have become polluted. The river Damodar is perhaps the most heavily polluted river. River Mini-Mahi in Baroda has been another heavily polluted river, which is having a variety of industrial and petrochemical wastes. The river Cooum flowing through Madras has been got polluted by sewage so much that not even the zooplanktons have been able to thrive in it. One litre of Cooum wate is having as much as 900mg or iron, 275mg of lead,1313mg of nickel, and 32mgof zinc. Besides heavy metals, very high levels of phosphates, silicates and nitrates also occur in the water. The river Ganga from Hardwar to Calcutta is regarded as one unending sewer which is fit only to carry urban liquid waste, half burnt dead bodies, carrion, pesticides and insecticides. Nearly 312 industrial units are dumping their waste into the river, only a dozen have effluent treatment facilities. The 27 cities contribute 902 million litres of water to the river each day. Many of our lakes, notably the Dal lake, are becoming darkened, smelly and choked with excessive growth of algae.

Agricultural Water Pollution

Agricultural pollution is caused by refuse of any form from agricultural operations of any kind. Specifically agricultural refuse includes the following types of waste.

- Manure and other wastes from farms and the operation of feed lots or poultry houses.
- Slaughter house wastes
- Fertilizer run off from crop land
- Harvest wastes
- Pesticides that escape in the atmosphere or into the water supply.
- Salt and slit drained from irrigated land or eroded land.

Apart from these specific pollutant there are several other types like animal discase agents, dead animals rural domestic wastes, food processing wastes and salinity of irrigation water.

Shipping water Pollution

It includes both human sewage and other wastes, the most important of which has been oil. Oil pollution, an oxygen-demanding waste, is of concern not only from sensational major spills and cleaning operation. Not all waste pollutants come from wastewaters. Some water pollution is caused due to solid wastes that are not prevented from

contaminating surface and groundwater, and some is caused due to the settling of air pollutants.

Control of Water Pollution

Water pollution control primarily involves treating of effluent discharged by industries and treating of sewage. The stages of sewage treatment have been designated as Primary, secondary and tertiary. Primary: It is mechanical process, which simply removes solids. Secondary: It is a biological process, which removes organic matter.

Tertiary: It removes all the remaining pollutants and other pollutants of importance such as phosphates and other dissolved inorganic compounds, which are difficult to be removed. Some of the tertiary treatment methods are:

- Chemical coagulation and Filtration method
- Carbon Absorption method.
- Chemical oxidation method.
- Ion Exchange method.
- Electro dialysis
- Reverse osmosis
- Air stripping
- Advanced biological systems.

The costs of advanced treatment will be somewhat higher than those of primary and secondary treatments but not very great considering the importance of pure water.

To safeguard water from further pollution, Government of India enacted the water (Prevention and Control of Pollution) Act, 1974 and formed the Central Board for Prevention and Control of Air Pollution.

Classification of water pollution

Marshall I Goldman and Robert Shoop have classified water pollution as follows:

1. Pollution by Putrefiable (foul smelling rotting of organic materials by bacteria) materials.
2. Pollution by heated effluents
3. Pollution by toxic materials
4. Pollution by inert materials and
5. Pollution by radio - active elements and compounds.

Pollution by Putrescible Materials

Putrescible wastes refer to foul smelling and rotting organic materials-materials like waste from humans, paper pulp plants, and canneries.

Accelerating the processof decomposition of these organic wastes controls organic pollution. When discharged into a stream or river or lake, the organic materials decompose by using large quantities of oxygen from water. If too much oxygen is removed and it takes too long for it to be restored, there may be serious pollution.

The amount of dissolved oxygen needed by decomposers to decompose organic materials in a given volume of water is called the biochemical oxygen demand (BOD).

This BOD is a measure of contamination of the wastewater. Human wastes are a major source of BOD. Sewage-laden wastewater entering a sanitary sewer has an average BOD level of 250 ppm. The sewage-laden wastewater contains only 8ppm (parts per million) of oxygen. Hence its oxygen is quickly depleted through microbial decomposition of sewage. In fact the decomposition of the daily wastes of single person requires all the dissolved oxygen (DO), in 9000litres(2200 gallons) of water. Some concentrated industrial wastes have BOD levels greater than 30,000 ppm. Other sources of high-level BOD wastes include run off from livestock feed lots and spoils dredged from harbours and canals.

Even mild cases of oxygen depletion fish such as trout will not have adequate oxygen for their needs. Consequently they may die or be forced to move elsewhere. Scavenger fish like carp, which require less oxygen will only survive in such waters. Wastes from paper pulp mills discharge unusually large quantities of effluent, depleting all available dissolved oxygen.

The orginally-polluted area of the stream may be classified into three zones. The first zone is called the Zone of Immediate Pollution. Here the dissolved oxygen content is the lowest and the odour and colour of water is affected. The second zone is Septic Zone where content of dissolved oxygen is greater than in the zone os immediate pollution. Special aquatic organisms with low oxygen requirements like snails; sewage worms and rat-tail maggots may live in this zone. Because of the odour of decomposition, the area is usually easy to find. Finally there is Zone of Recovery, where the odours begin to disappear and fish like minnows and suckers begin to appear. There is usually a large bloom of plant life or algae on the borders of Zone II and Zone III. The increased quantity of oxygen combines with decomposed organisms to break down the last traces of the organic material and create highly fertile condition.

Pollution by Heated Effluents

Oxygen is readily restored when the water is cool. The hotter it is, lower the oxygen holding capacity of the water. The bubbles that arise from heated water demonstrate what happens to the gases in hot water. The discharge of clean hot water into an unpolluted stream is hence as harmful as the discharge of organic wastes. In both cases, oxygen content of water is reduced. It is because of this that water pollution is a serious matter in tropical countries. The temperature is always so warm that it is difficult for the streams to absorb the necessary quantities of oxygen. Hot water rise discharged into watercourses by industries that use water for cooling. Such heated water is extremely harmful to the fish population and many other organisms, which survive only in a restricted temperature range.

Pollution by Toxic Wastes

Toxic wastes are those, which do not easily settle out and are not easily broken down by biological means. Such toxic wastes like d mercury are poisonous when consumed or contacted by plants and animals. Pesticides and herbicides, which wash off the land into the sewers, are other examples. Recently the dumping of wastes containing cyanide into the river at Ezhil Nagar, Tamil Nadu on the outskirts of Madras city is an example of this kind of pollution.

The mercury poisoning of hundreds of people in Minamata, Japan is another example.

Pollution by Inert Wastes

Inert wastes are those, which enter water as solids but are not involved in chemical reactions. Such wastes include dust, metal filings, oil films, dust and silt from soil erosion. They are removed by mechanical means such as filtering or allowing for sedimentation; these materials if not removed settle to the bottom of watercourse and block sunlight. As a result plant life is affected which in turn cuts off the food supply of the coast of Connecticut, Rhode Island and Massachusetts have been buried with inert wastes. Pollution from inert wastes is also a serious problem in areas located near mines.

Pollution by Radio-active Wastes

Radioactive wastes are produced in the processing of uranium and other radioactive substances or in testing of the nuclear devices that produce nuclides in blast device and fall out. It may take years for the level of radioactivity in the water to fall. Practically the only way known to dispose of such materials is to dump them into ocean beyond the continental shelf or pump them into abandoned mines and deep wells. Even this may cause pollution of oceans and under ground water supplies.

Chapter 12

ECONOMIC DEVELOPMENT: CONCEPTS AND APPROACHES

The Economics of Development refers to the problems of the economic development of underdeveloped countries. Though the study of economic development has attracted the attention of economists right from Adam Smith down to Marx and Keynes, yet they were mainly interested in the problems which were essentially static in nature and largely related to a Western European framework of social and cultural institutions.

Economic Development and Economic Growth

Generally, economic development refers to the problems of underdeveloped countries and economic growth to those of developed countries. Maddison makes the distinction between the two terms in this sense when he writes: “The raising of income levels is generally called economic growth in rich countries and in poor ones it is called economic development.” But this view does not specify the underlying forces, which raise the income levels in the two types of economies. Hicks points out in this connection that the problems of underdeveloped countries are concerned with the development of unused resources, even though their uses are well known, while those of advanced countries are related to growth, most of their resources being already known and developed to a considerable extent..

In fact, the terms development and growth have nothing to do with the type of economy. The distinction between the two relates to the nature and causes of change. Schumpeter makes the distinction clearer when defines *development as a discontinuous and spontaneous change in the stationary state which forever alters and displaces the equilibrium state previously existing; while growth is a gradual and steady change in the long run which comes about by a gradual increase in the rate of savings and population*. This view of Schumpeter has been widely accepted and elaborated by the majority of economists. Accoding to Kindleberger, “ *Economic growth means more output, while economic development implies both more output and changes in the technical and institutional arrangements by which it is produced and distributed*. Growth may well involve not only more output derived from greater amounts of inputs but also greater efficiency, i.e. increase in output per unit of input. Development goes beyond this to imply changes in the composition of output and in the allocation of inputs by sectors. Friedmann defines growth as an expansion of the system in one or more dimensions without a change in its structure, and development as an innovative process leading to the structural transformation of social systems.

Thus economics growth is related to a quantitative sustained increase in the countries per capita output or income accompanied by expansion in its labour force, consumption, capital, and volume of trade. On the other hand, economic development is a wider term. It is related to qualitative changes in economic wants, goods, incentives, and institution. It describes the underlying determinants of growth such as technological and structural changes. Development embraces both growth and decline. An economy can grow but it may not develop because poverty, unemployment and inequalities may continue to persist due to absence of tehnological and structural changes. But it is difficult to imagine development without economic growth in the absence of an increase in output per capita, particularly when population is growing rapidly.

Despite these apparent differences, some economists use these terms as synonyme. Arthur Lewis his The Theory of Economic Growth writes “most often we shall refer only to

growth but occasionally for the sake of variety, to progress or to development." These terms will also be used as synonyms throughout this text.

Role of Agriculture and Industry in Economic Development

The contribution of agriculture to economic development lies in: 1. Providing more food to the rapidly expanding population; 2. Increasing the demand for industrial products and thus necessitating the expansion of the secondary and tertiary sectors; 3. Providing additional foreign exchange earnings for the import of capital goods for development through increased agricultural exports; 4. Increasing rural incomes to be mobilized by the state; 5. Providing productive employment; and 6. Improving the welfare of the rural people. We discuss these one by one.

In LDCs, food production dominates the agricultural sector. When output expands with increased productivity, it increases the income of the framers. Raise in per capita income leads to substantial rise in the demand for food. In such economies, the income elasticity of demand for food is very high. It usually ranges between 0.6 and 0.8 per cent. Moreover, the increase in the growth rate of population due to a rapid decline in the mortality rates and slow reduction in fertility rates tends to raise further the demand for food. Besides, the demand for food increases with the expansion of population in towns and industrial areas. Taking these factors into consideration, the increase in farm output should be at a higher rate than the rate of increase of food demand. In a situation where the increased production of agricultural commodities lags behind the growth in demand for them, there will be a substantial rise in food prices. To offset domestic shortage and prevent rise in prices, food may be imported from abroad but it can be at the cost of capital goods needed for development. The state may also introduce price controls, rationing and compulsory food collection. All this emphasizes the importance of increase in food production in LDCs.

A rise in rural purchasing power, as a result of the increased agricultural surplus, is a great stimulus to industrial development. The market for manufactured goods is very small in an underdeveloped country where peasants, farm labourers and their families, comprising typically two-thirds or four-fifths of the population, are too poor to buy any factory goods in addition to whatever little they already buy. There is lack of real purchasing power reflecting the low productivity in agriculture. The basic problem thus is low investment -returns caused by the small size of the market. Increased rural purchasing power caused by expansion of agricultural output and productivity will tend to raise the demand for manufactured goods and extend the size of the market. This will lead to the expansion of the industrial sector. Moreover, the demand for such inputs as fertilizers, better tools, implements, tractors, irrigational facilities in the agricultural sectors will lead to the greater expansion of the industrial sector. Besides, the means of transported to urban areas and manufactured goods to the rural areas. The long-run effect of the expansion of the secondary and tertiary sectors will be towards higher profits in them whether they are operated in the private or the public sector. These profits will tend to increase the rate of capital formation through their reinvestment. This is what Kuznets calls the "market contribution" of agriculture when it trades with others.

Underdeveloped countries mostly specialise in the production of a few agricultural goods for exports. As output and productivity of the exportable goods expand, their exports increase and result in larger foreign exchange earnings. Thus agricultural surplus leads to capital formation when capital goods are imported with this foreign exchange. As development gains momentum due to industrialization, the proportion of agricultural exports in country's total exports is likely to fall, as they are needed in larger quantities for domestic production of imported articles. Such articles are import substitutes and conserve foreign exchange. Similarly, increased marketed surplus of food grains leads to

a net saving of foreign exchange, as the economy tries to achieve the goal of self-sufficiency in food production. Larger production of food and export crops not only conserve and earn foreign exchange but also lead to the expansion of the other sectors of the economy. Foreign exchange earnings can be used to build the efficiency of other industries and help the establishment of new industries by importing scarce raw materials, machines, capital equipment and technical know-how. Kuznets calls it the "product contribution" of agriculture which first augments the growth of net output of the economy, and second, the growth of per capital output.

An underdeveloped country needs large amount of capital to finance the creation and expansion of the infrastructure and for the development of basic and heavy industries. In the early stages of development, increasing the marketable sruplus from the rural sector without reducing the consumption levels of farm population can provide capital. According to Johnston and Mellor, "An increase in agricultural productivity implies some combination of reduced inputs, reduced agricultural prices or increased farm receipts". Labour as the principal input can be a source of capital formation when it is reduced on the farm and employed in construction works. But the possibility of utilising unskilled surplus farm-labour on capital projects requiring skilled labour is limited. The second possibility of increasing capital formation through reduced agricultural prices is also not feasible in the early stages of development when the rise in prices is inevitable. Reduction in agricultural prices is possible in the long -run but democratic countries may not be able to follow this policy for political reasons. A more practicable solution is to stabilise the prices of farm products. The third possibility of increasing farm receipts is perhaps the best way of capital formation. This can be done by mobilising increased farm incomes through agricultural taxation, land taxes, agricultural income tax, land registration charges, school fees, fee for providing agricultural technical service and other types of fee that cover all or part of the cost of services provided to the farm population. But "political and institutional problems make it difficult to translate the increased potential for saving and capital accumulation, made possible by increased agricultural productivity, into an actual increase in investment", in underdeveloped countries. According to Wald, special assessments have had their widest application in the United states. In view of the fact that they are specially designed for financing such development projects a irrigation works, flood control system and certain classes of roads, all of which are extremely important for underdeveloped countries". Expect for betterment levy in a few states no other assessment exist in India. Earnings from land revenue are on the decline and agricultural income tax is not favoured due to political reasons. Wald, therefore, warns underdeveloped countries like India " the penalties of too light taxation of agriculture are a stagnating farm sector, a financially starved public sector and a retarded rate of economic growth in the country as a whole". Thus in countries where agriculture dominates, the taxation of agriculture in one form or another is essential for mobilising agricultural surplus in order to accelerate economics development. Kuznets calls it the "factor contribution" of agriculture when there is a transfer of resources to other sectors, these resources being productive factors.

Agriculture also expands and diversifies employment opportunities in rural areas. As agricultural productivity and farm income increase, non-farm rural employment expands and diversifies. Landless and marginal farmers are primarily engaged in non-agricultural pursuits which include the manufacture of textiles, furniture, tools, handicrafts, leather and metal working; processing, marketing, transport, repair work; construction of houses and other building; education, medicine and other services. All these activities satisfy local demand.

Lastly, increase a rural incomes as a result of the agricultural surplus tends to improve rural welfare, Peasants start consuming more food especially of a higher nutritional value in the form of superior quality cereals, eggs, ghee, milk, fruits etc. They build better

houses fitted with modern amenities like electricity, furniture, radio, fan, etc. Provide themselves with bicycle, motorcycles, watches, readymade garments, shoes etc. They also receive direct satisfaction from such services as schools, health centres, irrigation, banking, and transport and communication facilities. Thus increased agricultural surplus has the effect of raising the standard of living of the mass of rural people.

The Place Of Agriculture In The National Economy

Agriculture forms the backbone of the Indian economy and despite concerted industrialisation in the last four decades; agriculture occupies a place o f pride. Being the largest industry in the country, agriculture is the source of livelihood for over 70 per cent of population in the country. The significance of agriculture in the national economy can be best explained by considering the role of agriculture under different heads.

(I) Share of Agriculture in the National Income. Figures supplied by the National Income Commettee and the Central Statistical Organisation show clearly that agriculture contributed 57 per cent of the national income in1950-51 but contributed now around 32 per cent of the national income. Two important facts must be emphasised here. Firstly agriculture contributes even now a major share of the national income in India. Secondly, the share of agriculture in national income, however, has been decreasing continuously and the shares of the manufacturing and service sectors are increasing. This is as it should be.

Comparison can be made between the positions of agriculture in India with that in the other countries as regards the share of agriculture in national income. In the United Kingdom, agriculture contributes only 2 per cent of the national income; in U.S.A. It is 3 per cent; in Canada it is 4 per cent; in Australia it is 5 per cent; and so on. The more developed a country, the smaller is the share of agriculture in national output. India, having not yet reached the stage of advanced economy, has an agricultural sector, which is still the dominant one in the country.

(ii) Indian Agriculture and Pattern of Employment in the Country. Agriculture dominates the economy to such an extent that a very high proportion of working population is India is engaged in agriculture. According to India's census figures between 67 to69 per cent of India's working population is engaged in agriculture. But in the United States, only 2 to 3 per cent of the working population is engaged in agriculture; in France, the proportion is about 7 per cent; and in Australia, this is developed countries that the working population engaged in agriculture in quite high. For instance, it is 42 per cent in Egypt, 50 per cent in Burma, 52 per cent in Indonesia and 72 per cent in China.

(iii) Important of Agriculture for Industrial Development. India agriculture has been the source of supply of raw materials to our leading industries. Cotton and jute textile industries, sugar, vanaspati and plantations- all these depend on agriculture directly. There are many other industries, which depend on agriculture in an indirect manner. Many of our small-scale and cottage industries like handloom weaving, oil crushing, rice husking, etc., depend upon agriculture for their rea materials together they account for 50 per cent of income generated in the manufacturing sector in India.

But then, in recent years, the significance of agriculture has come up which are not dependent on agriculture. Under the Five -Year Plans, iron and steel industry, chemicals, machine tools and other engineering industries, aircraft, etc., have been started. However, in recent years, the importance of food processing industries is being increasingly recognised both for generation of income and for generation of employment.

(iv) Role of Agriculture in the Field of International Trade: Importance of Indian agriculture also arises from the role it plays in India's trade. Agricultural products-tea, sugar, oilseeds, tobacco, spices, etc., -- constitute the main items of exports of India. Broadly speaking, the proportion of agricultural goods, which are exported, may amount to 50 per cent of our exports, and manufactures with agricultural content (such goods as manufactured jute, clothe and sugar) contribute another 20 percent or so; and the total comes to 70 per cent of India's exports. This has great significance for economic development. For, increased exports help the country to pay for the increased imports of machinery and raw materials.

(v) Role of Agricultural Sector in Economic Planning: Importance of agriculture in the national economy is indicated by many facts. For example, agriculture is the main support for India's transports system, since railways and roadways secure bulk of their business from the movement of agricultural goods. Internal trade is mostly in agricultural products. Further, good crops implying large purchasing power with the farmers lead to greater demand for manufactures and, therefore, better prices. In other words, prosperity of the farmers is also the prosperity of industries. Likewise, bad crops lead to a depression in business. Generally, it is the failure of economic planning. Finally, finances of the government, especially, have the State Governments, depends, to a large extent, upon the prosperity of agriculture.

It is clear, therefore, that agriculture is the backbone of the Indian economy and prosperity of agriculture can also largely stand for the prosperity of the Indian economy. At the same time, it is true that per capita productivity in agriculture is less than in industry. Naturally, most scholars of under-developed economies observe that this dominance of agriculture in India's economy is responsible for the low per capita income in the country. In their opinion, so long as the Indian economy is dominated by agricultural activity, per capita income will not rise to an extent, which is considered desirable.

Chapter 13

POVERTY IN INDIA

Poverty can be defined as a social phenomenon in which a section of the society is unable to fulfil even its basic necessities of life. When a substantial segment of a society is deprived of the minimum level of living and continues at a bare subsistence level, that society is said to be plagued with mass poverty.

Two types of standards are common in economic literature: the absolute and the relative. In the absolute standard, minimum physical quantities of cereals, pulses, milk, butter etc are determined for a subsistence level and then the price quotations convert into monetary terms the physical quantities. Aggregating all the quantities included, a figure expressing per capita consumer expenditure is determined. The population, whose level of income is below the figure, is considered to be below the poverty line. According to the relative standard, income distribution of the population in different fractile groups is estimated and a comparison of the levels of living of the top 5 to 10 per cent with the bottom 5 to 10 per cent of the population reflects the relative standards of poverty. The disadvantage of the relative concept is that it indicates the relative position of different segments of the population in the income hierarchy.

Causes of poverty

Underdevelopment: Due to underdevelopment, a large portion of the population has to go without the most essential needs of daily life because total national income, and hence aggregate consumption, is too small relatively to the enormous size of population.

Inequality: Extreme inequality of income and wealth is another cause of poverty. As pointed out by the planning Commission, underdevelopment and inequality are the twin causes of poverty.

Low per capita income: Poverty is also reflected by the low per capita income.

Inadequate growth rate: One reason for the failure of planning to make a major dent on poverty has been the inadequate growth rate.

High growth rate of population: The growth rate of population has been very high in India as against the growth rate of the economy. This has failed to bring about the required improvements in living standards. During the first decade of planning 1951-61, the growth rate of population was 21.64 per cent, and during the second decade 1951-71, it was 24.8 per cent, in the decade 1971-81, it was 24.75 per cent. Such high growth rate of population accompanied by the low growth rate of the economy brings down the per capita income and the per capita consumption expenditure, and thus increases poverty.

Unemployment: Poverty is also on the increase with the rise in the number of the unemployed. The number of unemployed persons has been increasing with every Five-Year Plan. The First Five Year Plan started with a backlog of 3.3 million unemployed persons and at the end of the plan they had increased to 5.3 million to 7.1 million at the end of the Second plan, to 9.6 million at the end of the Third, to 13.6 million at the end of the Fourth plan, 20.6 million at the end of Sixth and40 million at the end of Seventh plan. Thus increasing unemployment and underemployment in families has accentuated poverty.

Low availability of essentials: Another cause of poverty is the low standard of living, which is primarily reflected, in the low availability of essential commodities.

Inflation: Continuous rising prices are another cause of poverty. When prices rise the purchasing power of the money falls and they lead to the impoverishment of the lower middle and poorer sections of the society.

Low Technology: Low level of technology is also responsible for the poverty in India. Not only manufacturing processes and agricultural production techniques are far below the standards of developed economies, but even marketing skills, the capacity to organise production units, and the financial markets are at low level. As a result of the low technology, per capita productivity remains at a low level. The return on capital employed and income fail to rise to the desired extent for a higher rate of capital formation thereby keeping the economy in a state of poverty.

Capital deficiency: Another cause of poverty has been the deficiency of capital in the country. This stems from the lower per capita availability of capital and the low rate of capital formation.

Social factors: The social factors such as indebtedness, illiteracy, ignorance, fatalism, conservatism, castes and joint family system are the major causes of poverty.

Poverty alleviation programmes

Since poverty and unemployment are inseparable, the policy measures for reducing unemployment are equally applicable for the removal of poverty.

In the 1950s and 1960s, Indian planners believed in the trickle down theory. According to this view, poverty alleviation was a gradual and automatic process as the economy grew. So the emphasis was on increasing the growth rate of the economy. Unfortunately, the trickle-down theory failed to eradicate poverty. Rather, poverty increased over the years. This led the planners to adopt four broad categories of programmes in stages for poverty alleviation.

- Resource and Income development programmes for the rural poor
- Special area development programmes
- Works programme for the creation of supplementary employment opportunities
- The Minimum Needs Programme (MNP) to improve the consumption levels of the poor in order to raise their productive efficiency

In the first category, a number of programmes have been in operation in the country, some since the 1970s. They aim at improving the economic conditions of the rural poor so that their incomes may increase. Special programmes in this category up to the Fifth plan had been Small Farmers' Development Agency (SFDA) and Marginal Farmers and Agricultural Labourers Development Agency (MFAL). But these programmes did not cover the whole country and their operation overlapped. They were operating simultaneously in the same area for the same people. Moreover, they had different funding patterns and did not cover the whole country. They were simply subsidy giving programmes and failed to develop resources and incomes of the rural poor. So from sixth plan one single integrated programme for the whole country was introduced. It is known as the Integrated Rural Development Programme (IRDP). It aims at improving the lot of the rural poor consisting of the landless labourers, small and marginal farmers, rural

artisans and other workers. IRDP includes creation of productive assets and/or appropriate skills and vocational opportunities backed by services to increase production and productivity. Those having small land are provided inputs like water, improved seeds and fertilizers to improve the productivity of the land. To augment the incomes of the landless and the landholders, the programme aims at diversification of agriculture through animal husbandry, dairying, forestry, fishery etc., The programme also includes processing and manufacturing activities based on local resources and improvement of post-harvest technology to benefit producers and consumers from increased production. Village and cottage industries and services sector are encouraged through the supply of credit, raw materials, consumer based designs and marketing facilities. In the Sixth plan, Rs.4500 crores were made available for IRDP with a 20 per cent subsidy component.

In the second category are included such programmes as Drought Prone Area Programme (DPAP) and Desert Development Programme (DDP). These special area development programmes aim at optimum utilisation of land, water and livestock resources, farm forestry, dairy development and development of subsidiary occupation in drought prone and desert areas to raise the incomes of the weaker sections of the society.

In the third category are included such employment generation programmes as NREP, RLEGP, TRYSEM and the Food for Work Programme which aim at creating supplementary employment opportunities during lean employment periods of the years.

The Minimum Needs Programme which aims at improving the consumption levels of the poorer sections in order to raise their productive efficiency. This includes the provision for elementary education, health, water supply, roads, electrification, housing to landless labourers, nutrition, and improvement of urban slums. Various components of this programme such as construction of roads, water supply and housing are also meant to generate additional employment and income to the poor.

For better implementation and results of the poverty alleviation programmes in force, the Seventh plan adopted three-pronged strategy:

Poverty alleviation programmes would be formulated and implemented in a decentralised manner with the participation of people at the grassroots level through village Panchayats, block Panchayats, and district Panchayats etc.,

Better planning at the district level involving various disciplines or departments, tighter organisational set-up to ensure optimal use of resources and closer monitoring, and

Taking up group oriented activities for beneficiaries, to the extent possible, through the promotion of cooperatives, registered societies etc so that the economies of scale is fully realised.

Chapter 14

FOOD PROBLEM AND FOOD POLICY IN INDIA

The partition of the country in 1947 further weakened India on the food front, as India received 82 per cent of the population, but only 75 per cent of acreage under cereals and 69 per cent of irrigated area. The important implications of the food policy inherited by the Government of India at the time of independence were as follows:

- Extension of the rationing system made the Government committed to feeding all the consumers
- Procurement of internal supplies failed to keep with the expanding government commitments making it necessary to import food grains
- Imports of food grains steadily increased till it touched 2.7 million tonnes in 1947 and
- As imported food grains were more expensive than the locally produced food grains, the government had to subsidise the distribution of foreign food grains.

The GOI appointed the Food grains Procurement Committee (1950) to examine the food question again. According to the 1950 Procurement Committee, the basic problem was that public procurement did not match with the commitments of public distribution. The basic problem was inadequate domestic production and supplies of food grains to the people.

PL 480 Agreement, 1956

The GOI entered into an agreement in 1956 with U.S.A., called as the PL 480 agreement, for the import of 3.1 million tonnes of wheat and 0.19 million tonnes of rice for the next three years. The GOI found the PL 480 food imports a good tool to stabilise food prices in the country, since it could release unlimited quantities of imported wheat at the lowest possible price to create a psychological feeling of abundance and to bring down the price of food grains in the country.

Food grains Enquiry Committee, 1957

The GOI appointed the Food grains Enquiry Committee in 1957, which completely endorsed the government's food policy.

The food policy formulated in 1956 and strongly endorsed by the Food grains Enquiry Committee, 1957 crumbled during the last year of the Third Plan when production of food grains fell to worst possible level, 72 million tonnes which was less by 17 million tonnes as compared to the record 1964-65 production of 89 million tonnes.

Integrated Food Policy since 1966

The GOI has set up another Food grains Policy Committee in 1966 to review the food problem afresh. The 1966 Policy Committee recommended national plan of supply and distribution of food grains:

- Procurement of food grains to ensure necessary supplies

- Control on interstate movement of food grains to facilitate procurement and keep prices at a reasonable level

- A system of public distribution of rice and wheat to ensure equitable sharing and

- Building up of large buffer stock of food grains to provide against difficult years i.e. accumulate large stocks of food grains in years of abundant production and use the same in years of low production and higher prices. The recommendations of Food grains Policy Committee (1966) were called the new Integrated Food Policy.

Buffer stock, Procurement and Distribution: Buffer stock refers to the stock maintained by the government to be used as a buffer to cushion the shocks of fluctuating supply and price, to meet the emergency needs and to meet the situations arising out of serious unexpected shortages resulting from transport bottlenecks, natural calamities like war, flood, famine, earthquakes etc., The government enters the market and purchases food grains for the maintenance of buffer stock. This can be built either by internal purchases or imports from foreign countries. It is maintained by the Food Corporations of India.

Procurement refers to securing food grains by the government or its agencies to meet the requirements for the supply to consumers through fair price shops, and to build a buffer stock to meet emergency needs in agriculturally slack year. The prices at which procurement operation is carried out are referred to as procurement prices. The required quantity of food grains is procured at the preannounce procurement prices in the internal market. These procurement prices are usually lower than the market prices. It is announced by the government before or at the time of harvest season on the recommendations of the Commission for Agricultural Costs and Prices (CACP) after considering the prevailing demand and supply in the market.

Monopoly procurement refers the government acquires monopoly rights for the purchase of food grains form farmers. Traders are not allowed to enter the market.

The distribution of food grains to the vulnerable sections of the society at fair prices during periods of scarcity and rising prices is the ultimate aim of the policy of the procurement and storage of food grains by the government. Local traders as agents distribute mainly through fair price shops, co-operative societies and food grains on specified terms and conditions.

Public Distribution System (PDS): It was initiated in 1939. The objective is mainly to check the speculation by grain merchants and to distribute food grains to the vulnerable sections at fair prices. It is supposed to play three important roles: Public distribution as a relief operation, Public distribution as a controlling device to protect the levels of consumption of the lower groups during a price rise and Public distribution as a redistribution mechanism.

Takeover of Food grains Trade, 1973

The take over of wholesale trade in food grains was first recommended by the Food grains Enquiry Committee (1957) for the purpose of stabilisation of prices. The major objectives are:

- To assure regular supplies of wheat, and rice to consumers at reasonable prices

- To stabilise the prices of food grains at a level which covered the cost of production and provided adequate incentives to producers to increase their production

- To remove large fluctuation in prices in response to local or seasonal variations in supply and demand

- To prevent the unsocial activities of the wholesalers and middlemen and

- To eliminate middlemen and force farmers to sell their surplus grains directly to government agencies.

Food Problem during 1980s and 1990s

The failure of Government takeover of wheat in 1973 coincided with the failure of internal production of food grains in the country. This led to steep rise in prices of all commodities fuelled by rise in the prices of food grains and complete breakdown of PDS in many parts of the country. The GOI declared emergency in June 1975 and controlled the situation.

In a real sense, India does not face the food problem any more, in the sense of shortage of food grains to meet the demand of the teeming population at affordable prices.

In the last 50 years, India's food problem has changed fundamentally. At the time of Independence, India's food problem was on of scarcity, particularly shortage of rice and wheat. The major concern of the Government was to increase the domestic supplies through increased production Grow-more -food programmes - and through more imports.

In the second half of 1950s and during 1960s the major concern of the Government shifted to control of food grains prices, for the Government was assured of regular imports from U.S.A. to supplement internal production. In fact P.L. 480 imports were the basis of our agricultural and industrial development. It was in this period that the new agricultural strategy was introduced giving a tremendous fillip to agricultural productivity and agricultural production.

Between 1967-68 and 1995-96 Punjab, Haryana and Uttar Pradesh have recorded annual growth rates of 5.4 per cent, 5 per cent and 3.4 per cent respectively in foodgrains production. These states are the backbone of our public distribution system the largest such system in the whole world. These states have effectively protected the country from any serious food grains crisis and famine situations.

In the 1970s the Government of India adopted a policy of stockpiling food grains, with a target of 5 million tonnes. Eventually the Government had succeeded in accumulating over 30 million tonnes of buffer stock in food grains during the 1980s and 1990s. In fact, it was the huge reserves of food grains which helped the Government to tide over successfully the three years of poor food grains production, culminating in the widespread drought of 1987-88.

The food problem, as explained already, does not exist any more in the form of shortage or of high prices, but of

- How to enable the lower income groups to purchase the available food grains at affordable prices, and

- How to make use of the huge food stocks to help accelerate the process of economic growth.

The food for work Programme has been designed since 1977-78 to provide work for the rural poor, for the unemployed and the famine-stricken, and at the same time create durable community assets. The Government is also implementing a scheme to provide

food grains to the weaker sections, especially in the tribal areas, at a price well below the already subsidised price in the public distribution system.

Chapter 15

CAPTIAL FORMATION IN AGRICULTRE

Among the many factors, responsible for underdevelopment, lack of capital formation is considered to be a factor of prime importance. It is therefore, necessary that certain conceptual problems associated with capital formation be fully understood.

According to Professor Nurkse: “The meaning of ‘Capital formation’ is that society does not apply the whole of its current productive activity to the needs and desires of immediate consumption, but directs a part of it to the making of capital goods, tools and instruments, machines and transport facilities, plant and equipment -- all the various forms of real capital that can so greatly of the process, then is the diversion of a part of society’s currently available resources to the purpose of increasing the stock of capital goods, so as to make possible an expansion of consumable output in the future.” This definition of capital formation by Prof.Nurkse exphasizes the inclusion of real physical assets and not financial assets such as shares and bonds, currency notes and bank deposits (which are all paper claims). It is only the increase of real capital, which increases the productive potential of the society.

The definition of Professor Nurkse emphasizes only the physical aspect of capital and ignores the aspect of “investment in men” that is made by the society in the form of expenditures on health and education. The basic characteristic of capital is that it helps to enlarge the productive potential of the society. Judged from this standpoint, investment - in-men, more appropriately described as human capital, should be included within the scope of capital, should be included within the scope of capital. Professor Simon Kuznets has rightly pointed out measures of capital formation based on fixed capital are deficient because they omit expenditures for education, non-profit research, health, recreation,etc., which “contribute to economic growth by increasing the efficiency of a complex productive system.” Even the classical economists to deal with material objects led to the adoption of a narrow definition of capital, which help to enlarge the productive capacity of a nation. prof. T.W. Schultz pleading for a revision of the definition of capital writes :” Surely one of the major reasons for the widely held popular belief that economics is materialistic is the over-commitment on the part of economists to a partial concept of capital restricted to material objects. The failure to include the acquired abilities of man that augment his economic productivity as a form of capital, as a produced means of production, as a form of capital, as a produced means of production, as a product of investment, has fostered the retention of the patently wrong notion that labour is capital free and it is only the number of man-hours worked that matters. But ...labourers have become capitalists in the sense that they acquired much knowledge and many skills that have economic value. Clearly which is needed in this connection is an all-inclusive concept of capital”.

Although the traditional estimates of capital formation made in India preferred to restrict the term capital formations to additions to the stock of producer good viz., machines, tools, equipment, transport facilities, etc., efforts have been made in recent years to estimate human capital formation as well. We shall therefore, enlarge the definition of capital formation and study both the components of capital formation- **physical and human**-- with reference to India.

The Process of Physical Capital Formation

There is a close relationship between economic growth and capital accumulation. A silent assumption runs through most of the theories of capital at a particular time in a country whether there is abundant labour or not. But it may be emphasized that a high rate of capital formation is usually accompanied by a rapid growth in productivity and income but it would be a folly to pin exclusive faith on this factor alone. Professir Nurkse has aptly put it, “Capital is a necessary but not a sufficient condition of progress”. Since capital formation is an essential determinant of economic growth, it is quite necessary to determine the desirable rate of capital formation and also determine the process of capital accumulation. Most of the theories of capital accumulation believe in stepping up the rate of capital formation in a short period of time. The main purpose of this approach is to compress the process of economic growth in a relatively short period.

Professor P.N. Rosenstein Rodan in his theory of the Big Push has also emphasised that the philosophy of gradualism will not work in starting economic growth, the economy needs to be given a big push. Proceeding ‘bit by bit’ will not add up in its effect to the sum total of single bits. A minimum quantum of investment is a necessary (though not sufficient) condition of success.

How can a community achieve a high rate of investment or capital formation? The process of physical capital accumulation is a function of three variables:

1. An increase in the volume of real domestic savings so that the resources that would have been used for consumption are released for investment.

2. The creation of adequate banking and financial institutions to mobilise the saving of the community.

3. The emergence of an entrepreneurial class, which can utilise the community’s saving into channels of productive investment or the assumption of the entrepreneurial function by the State in critical areas.

Different economies adopted different ways to boost up the rate of real saving in the community. The bootstraps approach followed by Communist Russia and other centrally planned economies was intended to achieve a high rate of domestic saving by imposing curbs on consumption. Similarly, in the British economy, the same objective was achieved by keeping wages low and ploughing back business and industrial profits for economic expansion. Both these courses are extreme. In India, the emergences of a democratic government and a class conscious labour force would not permit either the use of totalitarian measures to restrict consumption or to keep wages depressed at a very low level for a long time. Consequently, domestic savings alone may not be sufficient for planned investment. A part of investment may, therefore, be financed by the import of foreign capital. External assistance is a short-term measure because in the ultimate analysis the entire burden of economic growth has to be borne by the developing community.

The Indian economy has outlined a path of capital accumulation for itself in which a major part of resources needed for economic development were to be supplied by real domestic savings and a part by inflow of capital from abroad. In order to initiate the conditions of take-off, a higher rate of capital inflow was admitted in the Second and Third Plans, but from the Fourth Plan onwards, an effort, was made to progressively reduce the quantum of foreign aid so as to make the economy self-reliant and self-sustaining.

Capital formation in Indian agriculture

Table.15.1.Trend in Capital formation in Indian agriculture

(Rs.in crores)

Year	Gross capital formation in agriculture & allied secto			Gross capital formation of the economy			Share of agriculture (%) to total capital formation in the economy		
	Public sector	Private sector	Total	Public sector	Private sector	Total	Public sector	Private sector	Total
1960-61	133	230	363	1190	1607	2797	11.2	14.3	13.0
1970-71	348	644	992	2919	4387	7306	11.9	14.7	13.6
1980-81	1892	2018	3910	12106	15677	27783	15.6	12.9	14.1
1990-91	3628	8596	12224	53099	73276	126375	6.8	11.7	9.7
2000-01	7373	24257	31630	148106	260892	408998	5.0	9.3	7.7

Reasons for low capital formation

Low per capita income is the primary cause for the low rate of savings in India. Saving in an economy is the function of the income and when the majority of the people live below the poverty line, the rate of savings cannot be expected to increase considerably. Besides, there are abnormal inequality of income and wealth in our country and it is only the affluent people who can save and help in capital formation

Poor performance and contribution of public sector is another important cause for the low rate of capital formation. At present, the public administration is top heavy and the efficiency of the public undertaking is deplorably low due to non-utilisation of the fullest capacity.

Poor contribution by private corporate sector The contribution of this sector to domestic savings in India is very low and insignificant. To evade taxes, the Directors and the high executives are paid very heavily with lot of perks and thereby the funds are misused.

Savings potential of the rural sector not tapped fully Agricultural income is exempted from income tax and the savings potential of the agricultural sector has not been fully realised. Lack of banking habit, demonstration effect, conspicuous consumption, exemption of agricultural income from tax etc., have led to poor realisation of domestic savings.

Chapter 16

TECHNOLOGY DEVELOPMENT AND TRANSFER

" significant growth in productivity can not be brought about by the reallocation of resources (optimisation of resource use) in traditional agricultural systems. Significant opportunities for growth will become available only through changes in technology - new husbandry techniques, better seed varieties, more efficient sources of power and cheaper plant nutrients"

...T.W. Schultz

A thought on farm policies for India's future brings one's attention to the recent shift in emphasis in development economics from an earlier industrial fundamentalism to an emphasis on the significance of growth of agriculture. Concern is now with the conditions under which an agricultural surplus cans occur and be sustained. A new consensus seems to have emerged that rapid development particularly of the developing and less developed economies, depends critically on the achievement of rapid technological progress leading to productivity growth in agriculture.

A high payoff technological change will be one that facilitates the substitution of relatively abundant factors for relatively scarce factors in the economy. For example, high yielding crop varieties are essentially an input designed to facilitate the substitution of fertilizer for land. Likewise in an economy characterised by a relative scarcity of labour, substitution of land and capital for labour would be made possible primarily by improving agricultural implements and machinery. In agriculture two kinds of technology is available. Mechanical technology to labour saving and biological chemical technology for land saving.

There are three phases of technology transfer in agriculture. First, the material transfer, which indicates simple transfer of new materials such as seeds, plants, animals, machines and the husbandry or management practices, associated with these materials. The naturalisation of plants and animals tends to occur primarily as a result of trial and error by farmers.

Second, the design transfer characterised by the transfer of information in the form of blue prints, formulas, journals and books and the related software. Imported plant materials, animal stocks are subject to testing propagation and selection. Imported machines are tested and designs are copied or modified to adapt them to local conditions.

Third, the capacity transfer that consists of transfer of scientific and technical knowledge and the development of indigenous capacity to generate appropriate location specific technology. The objective is to institutionalise local capacity for invention and innovation of a continuous stream of locally adopted technology. An important element in the process of international capacity transfer is the migration of individual scientists and building of institutions with advanced research and development and training capacity.

Since independence, Indian agriculture is in a stage of transition from its semi feudal orientation to market orientation. In the fifties and the sixties, several land reform measures were introduced. With a slow progress, the impact of these measures could be felt only in the late sixties. Till then for the management of large farms, particularly in the context of growing population pressure on land, immediate attention was to make extensive use of available land.

Meanwhile, pressure on land increased manifold and the frontiers of extensive cultivation were closed. Existing technology left little scope for intensifying land use any further. Desperate need was felt for a new land saving technology. Timely was the transfer of technology embodied in the new high yielding varieties of wheat, rice and maize. This biological chemical technology is biased towards saving an increasingly scarce factor (land) and using increasingly abundant factor (fertilizers). With institutional and policy support it brought about the green revolution and India achieved self-sufficiency in food grain production.

Today, Indian agrarian structure reveals the existence of four distinct sectors. First, a sector consists of progressive entrepreneur farming. Based on capitalistic mode of production, this sector is ready to exploit any technological innovation. Second sector comprises of self-cultivating marginal, small and medium land owning peasants. Production in this sector is based on family labour and primarily for family consumption. Though numerically in majority, farmers in this sector are generally speaking in a state of semi-stagnation bordering on subsistence farming. Third, sector is composed of share croppers and various kinds of tenants and sub-tenants who have no property in land, and no security of tenure and are still subject to various forms of feudal exploitation such as rack renting, bondage and social and caste oppression. Fourth sector includes agricultural labourers for whom agriculture is the main stay and yet they have land to till. They work for wage and their labour is their only asset.

This agrarian structure would indicate the need for small farming technology, that is, the agricultural technology appropriate to the emerging agrarian situation must necessarily be small scale biased or scale neutral at the least. Therefore appropriate technology must be labour using and capital saving. It is necessary to direct the attention towards generation and adoption of labour using and land and capital saving technology. Such a technology would solve the problems of unemployment of landless agricultural labourers through their absorption in farm sector itself, at least till such time when agricultural growth induced industrial development and development of skill would permit significant transfer of labour out of agriculture into the industry.

To conclude, it must be observed that the strategy of attempting to protect agriculture from the impact of economic forces has in many countries resulted in wide disparities in economic welfare of the urban and rural population and severely restricted the contribution of agriculture to economic growth. In contrast, investment in institutions that would improve the capacity of the agricultural sector to respond to economic changes has been critical to the success of agriculture in a number of countries. The capacity to move from a natural resource based to a science-based agriculture to generate a continuous stream of technical innovations depends on substantial investment in research capacity. Equally important is the capacity of the country to undertake institutional innovations and reforms necessary to help farmers to respond to new technical opportunities, which become available to them. Institutional innovations, which facilitate internalising the benefits of innovative activity, become particularly important in creating the incentives for both innovative and productive behaviour of farm producers. In India, both research and institutional development are visible, but they are inadequate and unrelated. Future efforts must help coordination between them to bring comprehensiveness in research and development (R&D) programmes. In this, the governments have to take a leading and substantial role.

Chapter 17

ROLE OF HUMAN RESOURCES IN ECONOMIC DEVELOPMENT

The process of economic development involces the utilization of physical resources of a nation by the labour force of a country so that productive potential in a country is realised. In this effort of development there is no doubt that the labour force of the country makes a positive contribution, but it is equally true tha t rapidly growing population retards the process of development. The impact of rising population acting as a drag on economic resources is felt in a variety of ways. It would be of interest to examine the problem in this setting.

1. Populations and Growth of Nation Income. During 1960-61 and 1990-91 net national product at factor cost at 1980-81 prices) rose by 215 per cent, but on account of a rise in population by 92 per cent, per capita NNP rose by only 58 per cent. The annual average growth rate of national income works out to be 3.9 per cent (compound) and of per capita income to a only 1.6 per cent. With a decline in the rate of growth of population, the net increase in per capita income will rise, but a high growth rate of population is a retarding factor to raising the levels of per capita income in the country.

2. Populations and Food Supply. Even since Malthus wrote his celebrated Essay on Population attention was focussed on the problem of population versus food supply. There is no doubt that per capita cultivated area is gradually on the decline in India. Between 1921 and 1991, the cultivated area per capita dropped from 1.11 acres to 0.47 acres, indicating a fall of 58 per cent. To compensate for this fall in cultivated land-man ratio, it is imperative that efforts be made to ratio; it is imperative that efforts be made to raise productivity,

From table, it is clear that between1956 and 1995, net availability of food grains (cereals plus pulse) increase from 63 million tonnes to 168 million tonnes, signifying an increase of 167 per cent. But during the same period, population increased from 397 million to 816 million, i.e., 131 per cent. Consequently, per capita domestic availability of food grains increased from 431 grams to 502 grams signifying a very small increase of only 16.5 per cent in 29 years. This very marginal increase in the per capita availability of food grains is to a great extent attributable to the rapid rise of population.

Table.17.1. Net Availability of Food grains

year	population in million	Net availability of foodgrains (million tonnes)			per capita availability (in grams)
		cereals	pulse	total(in grams	
1956	397	53	10	63	431
1961	442	65	11	76	469
1972	562	86	10	96	467
1979	659	103	11	114	474
1984	738	117	11	128	478
1989	816	135	12	147	494
1990	833	132	13	159	510
1991	851	146	13	159	510
1995	916	156	12	168	502

Since a major part of the increase in population takes place in the rural areas it also signifies that the share of family consumption in total food production will increased and

much less will be left over as marketable surplus. These are gloomy forebodings, which stress the necessity of family limitation.

3. Populations and Burden of Unproductive Consumers. India's population can be broadly divided into productive consumers and unproductive consumers. The term productive consumers are being used for that part of the population, which contributes labour force of the country. Unproductive consumers comprise persons who are not engaged in employment. Broadly speaking, children, old persons and a part of the population in the age group 15-59, which do not seek employment, are included among non-productive consumers.

From the figures of working force given in Table , it is obvious that the ration of working to non-working population has deteriorated during 1961-81. While in 1961 unproductive consumer totalled about 256 million, in 1981 their number stood at about 464 million. Not only in absolute terms, even the proportion of non-productive consumers in the total population has gone up from 57 per cent in 1961 to62 per cent in 1981. However, the ration of working population during 1981-91 has remained unchanged, though the total number of non-workers has risen to 529 million. 42 per cent of the total population being in the age group 0-14, the child component of unproductive consumers is roughly 80 per cent of the non-working population. A high and increasing population of children increase the burden of the care of the young through nutrition, medical care, public health and education.

Economics calculate the dependency load of population of a country with reference to the contribution to productive of population as compared with its consumption. If we calculate the consumption needs, of an adult in the productive age group i.e., 15-59 as one, that of a child in the age group 0-14 as one -third and of an aged person

Table.17.2. Productive and Unproductive Consumers in India

Year	Total working population (productive consumers)		Total non-working population (unproductive consumers	
	million	per cent	million	per cent
1961	183	43.0	256	57.0
1971	175	34.2	372	65.0
1981	220	37.6	464	62.4
1991	315	37.6	529	62.4

(60 and above) as one-half (in the case of India in 1981, the population is composed of 40 per cent children, 54 per cent adults and 6 per cent aged persons), then for every 100 adults of productive age, there is a ration of 131 consumers equivalent. In a developed country where the age composition is in favour of the productive age group (on an average 23 per cent children, 67 per cent adults and 10 per cent aged), the equivalent of 100 adults in the productive age group is119 consumer units. Obviously, the age composition of population in a country like India indicates 10 per cent more dependency load as compared to an advanced country like the U.S.A.

4. Populations and Unemployment. Rising population is accompanied by a rise in the labour force of the community. Hence, it makes the solution of the problem of unemployment more difficult. As revealed in 1980 was 20.7 million, which represents 7.74 per cent of the total labour force. Eighth Plan (1992-97) has estimated the backlog of unemployed as 28 million in 1990. The increase in the unemployed both in absolute and relative terms, indicates that during the last 40 years of planning, the five-year plans were not even able to absorb the net additions to the labour force, not to speak of

clearing the backlog of unemployed. The problem of unemployment will become far more difficult in the future, obviously, a significant proportion of the national resources will have to be used to expand employment opportunities to absorb the increasing labour force and the backlog of unemployment left over due to the continuous pressure of a rapidly growing population.

5. Populations and the Burden of Education, Medical Care and Housing. Rising population increases the number of children and hence demands higher expenditure on education. There is no doubt that expenditure on education can be viewed as social investment in men that ultimately enhances the productivity of the labour force, but it may be emphasized that the time-lag in this respect is quite long and hence the direct effect in raising output per unit of investment is very low. Expenditure per pupil is estimated at Rs. 144 per year. The population in the age group 6-14 being 156 million in 1981 increase in expenditure on education will work out to Rs. 2,246 crores per year. Besides this, if one takes into account the expenditure on university education that will have to be increased as a result of pressure of pupils from the secondary schools, the total enhancement of expenditure on education will be still greater.

In addition to this, expenditure on medical care and public health will also call forth further investment. Not only that, the additional population has to be provided housing accommodation.

6. Increase in Population and Capital Formation. It is quite necessary that national income should grow at the same rate at which population is growing so that the existing level of real per capita income is maintained. The present rate of growth of population in India is 2.2 per cent per annum. To maintain a constant per capita real income national income must rise at the rate of 2.2 per cent per annum. To achieve this, capital investment is necessary. The capital -output ration for the Indian economy at present has been estimated at 5.5 which implies that about 5.5 units of capital are needed to bring about an increased of one unit of output. Thus, in order to bring about an increase of national income at the rate of 2.2 per cent, capital accumulation of the order of about 12 per cent (2.2*5.5) is necessary. George C. Zaidan of the London School of Economics has estimated the proportion of G.N.P that has to be invested in order to keep per capital income at a constant level. Whereas in the developed countries, the proportion of GNP that is wasted for this purpose is less than 5 per cent, in underdeveloped countries, like India, Columbia, Morocco,Brazil, Ghana and Tunisia, it is over 10 per cent . In view of the rising capital-output ratio in India, Zaidan's estimate is considered to be very low. This implies that very little is left over for raising the level of living of the masses. Recognising this fact, the Third Plan states:" In an underdeveloped economy with very little capital per person, a high rate of population growth makes it even more difficult to step up the rate of saving which, in turn largely determines the possibility of achieving higher productivity and incomes. Moreover, for a given investment, a large proportion will need to be devoted to the production of essential consumer goods at the expense of investment goods industries thereby still further slowing down the potential rate of growth".

All these factors lead us to conclusion that the fruits of development do not reach the people of India. While several other factors such as an in egalitarian system of land ownership and other forms of property, less emphasis on measures directed to help the weaker sections of the community and slow pace of economic growth in India during the last decade are mainly responsible for it, population growth is also an important factor in the situation. According to some experts, population explosion is the biggest roadblock in the path of economic progress.

It is unnecessary to debate whether India is over-populated or not. Even if it is, the surplus population cannot be decimated. What is needed is to increase our productive

capacity to support a large population on the one hand and to reduce fertility rates on the other so that growth of population is stabilised at a lower level.

Occupational Structure

The occupational structure refers to the distribution or division of its population according to different occupations.

Occupational Structure during 1951-91

The Planning Commission realised the need to effect a change in the occupational structure through the transfer of a part of the working force from agriculture to secondary and tertiary activities. The Second Five Year Plan stated: " By 1975-76 the proportion of agricultural labour force to the total should come down to 60 per cent or so. But for this to happen something like a fourfold increase in the numbers engaged in mining and factory establishment has to be brought about, and the investment pattern in the plans has to be adjusted to these requirements." Such a transfer of working force would necessitate:(a) an increase of productivity in agriculture itself so that the food and raw materials requirements of a growing economy could be adequately met, and (b) the formulation of an employment policy consistent with India's manpower needs and availability of indigenous resources.

Table.17.3. Occupational Classification of workers, 1951-1991

(per cent)

Particulars	1951	1961	1971	1981	1991
A.Primary sector	72.21	71.80	72.10	68.80	66.80
Cultivators	50.0	52.8	43.4	41.6	38.4
Agrl.Labourers	19.7	16.7	26.3	24.9	26.4
Livestock, forestry, fishing etc,.	2.4	2.3	2.4	2.3	1.9
B.Secondary sector	10.7	12.2	11.2	13.5	12.7
Mining and quarrying	0.6	0.5	0.6	0.6	0.6
Manufacturing	9.0	10.6	9.5	11.3	10.2
Construction	1.1	1.1	1.1	1.6	1.9
C.Teritiary	17.2	16.0	16.7	17.7	20.5
Trade and commerce	5.2	4.0	5.6	6.2	7.5
Transport and commn.	1.5	1.6	2.4	2.7	2.8
Other services	10.6	10.4	8.7	8.8	10.2
Total	100.00	100.00	100.00	100.00	100.00

Increase in agricultural productivity. Increased agricultural productivity is a necessity for changing the occupational pattern in India. For a long time, scarcity of land, fragmentation of agricultural holdings, faulty land tenure systems and primitive techniques of cultivation inhibited agricultural productivity and production. But from the beginning of 1960s there has been a technological breakthrough in agriculture and something of a green revolution has been ushered in this country. The new agricultural technology consists of extensive application of artificial irrigation, fertilisers and pesticides, better and hybrid seeds and agricultural mechanisation in selected promising areas. The new technology was expected to

(a) Produce more food grains and agricultural raw materials needed by industries;

(b) Reduce the size of agricultural population depending on land and at the same time create fuller employment for others through multiple cropping;

(c) Help create alternative employment in rural areas; and

(d) Generate surplus food to feed the growing non-agricultural labour in rural areas and industrial labour in urban areas.

Side by side with technological changes in agriculture, institutional reforms in the form of tenancy legislation to protect the tenants and land ceilings and distribution of surplus land among small peasants were also aimed a increasing agricultural production, and productivity in the country. Through this process, the Indian planners expected to transfer labour force from the agricultural sector to the other sectors.

Employment policy. A major objective of our plans was to mobilise, to the maximum extent, the abundant labour force in the country for purpose of economic development. Further, the productivity of labour was to be increased so that large employment could be provided at rising levels of real income. Planned economic development was expected to lead to considerable increase in employment opportunities. Rapid progress in expanding irrigation, power, basic industries, other industries, transport and other services, would generate new avenues of employment.

As irrigation facilities progressively increased and the scope for double and multiple cropping was correspondingly enlarged, seasonal unemployment would naturally diminish. At the same time schemes of rural electrification would encourage the setting up of small and large workshops and factories in rural areas. Many agro-based industries would come up and provide alternative employment to agricultural labourers. Ancillary employment like reclamation work, machine repair, and transport services, etc. would maintain rural employment lat a very high level. In urban areas, with rapid industrialisation and with corresponding expansion in transport and communication, banking and insurance and other services, there would be a tremendous increase in employment in the secondary and tertiary sectors. In this way, the Planning Commission anticipated a clear shift in the occupational pattern of the working force directly due to planned economic development.

There is, however, no significant change in the occupational structure in India since 1951, despite all efforts at rapid industrialisation. Table shows clearly that the work force in the primary sector was constant at 72 per cent between 1951 and 1971 and was about 67 per cent in 1991. The only change was that the proportion of cultivator's decline from 50 per cent I 1951 to 38 per cent in 1991, while that of agricultural labourers increased from 20 per cent to 26 per cent during the same period. This probably shows the growing concentration of land in a fewer hands, with small an marginal farmers being dispossessed of their land and joining the ranks of landless labourers.

Heavy investment service and I manufacturing sectors has made no impact as regards the pattern of occupational distribution since 1951. In fact between 1951 and 1971, 28 per cent of the working force was employed in the secondary and tertiary sectors-- there was a marginal decline in the secondary sector, made up by an equivalent increase in the tertiary sector. In 1991, however, there was an increase in the work force in the secondary and tertiary sectors-- from 28 per cent to 33 per cent.

Broadly, we can conclude that there was no clear shift in the work force from the primary to the secondary and tertiary sectors in the country since 1951. If we accept the thesis that economic development of a country is accompanied by a shift of the working population from the primary to the secondary and ultimately to the tertiary sectors, then clearly India is not on the road to economic progress.

Chapter 18

PROBLEMS OF FARM LABOUR

Having no access to land, the landless agricultural labour households form the bottom of the rural income scale. The following importance reasons explain low wages and poor economic conditions of agricultural labour.

(1) Low social status: Most agricultural workers belong to the depressed classes, which have been neglected for ages. The low casts and the depressed classes have been socially handicapped and they had never the courage to assert themselves. They have been like dumb-driven cattle.

(2) Unorganised. Agricultural workers are illiterate and ignorant. They live in scattered villages. Hence, they cannot easily be organised in unions. In urban areas workers can generally organise themselves and it is convenient for political parties to take interest in trade union activity. This is extremely difficult in case of farm labour. Accordingly, it is difficult for farm workers to bargain with the landowners and secure good wages.

(3) Seasonal employment. The agricultural workers do not have continuous work. On an average a farm labourer finds employment for about 200 days in a year and for the rest of the year he is idle. Apart from under -employment there is also unemployment in rural areas. Unemployment and under-employment are two important factors responsible for low income and consequently low economic position of the agricultural workers in India. But then the nature of work in agriculture is such that a farm labourer cannot get work continuously. In most cases, work on the farms is seasonal and intermittent. In many cases, there is single cropping which means work only for six to seven months in the year.

(4) Paucity of non-agricultural Jobs. Paucity of non-agricultural occupations in village area is another important factor for the low wages and poor economic condition of the farm labourers. For one thing, the growing pressure of population is increasingly felt in rural areas and the number of landless labourers is steadily increasing. For another, the absence of another occupation in rural areas and lack of inter-regional mobility have been responsible for worsening the pressure of population on land.

(5) Rural Indebtedness. Agricultural labour is heavily indebted. Normally, the farm labourers borrow from the landowners under whom they work. Since they have no security to offer, they pledge themselves to the moneylenders and rich landlords and become bonded labourers in many areas. Naturally, they are forced to accept lower wages.

Thus, partly because of factors beyond their control and partly because of their inherent bargaining weakness, the farm labourers have been getting very low wages and have, therefore, to live a miserable sub human life.

Government Measures Pertaining To Agricultural Labour

Since Independence, the Centre as well as the State Governments have taken some measures to improve the economic condition of agricultural labour. They include the passing of legislation to fix minimum wages for agricultural labour, the removal of disabilities, the ceilings on holdings and the redistribution of land among the landless labourers, etc.

(1) Indian Constitution. The Indian Constitution has declared the pratice of serfdom an office. It has abolished agrarian slavery including forced labour by law but it will take some time before it is removed in practice.

(2) Minimum Wages Act, The Minimum Wages Act was passed in 1948, according to which every State Government was asked to fix minimum wages for agricultural labour within three years. The minimum wages are fixed keeping in view the total costs and standard of living. Since conditions in various parts of the country are different and even within a state the law allows different rates of wages to be fixed. In practice minimum wages are very difficult to enforce effectively. In many states, the rates of wages. In practice, it has failed to increase the wages and earnings of agricultural labour.

(3) Other legislative measures. Law in all the States has abolished the zamindari system and with that all the exploitation associated with the system has been removed. Besides, tenancy laws have been passed in most of the states protecting the interests of the tenants and labourers, and enabling them to acquire the land they cultivate. Many states have passed legislation fixing ceiling on agricultural holdings by which the maximum amount of land, which a person can hold, has been fixed by law. According to these laws, the surplus land of rich landowners is to be distributed to the landless labourers.

(4) Organisation of labour co-operatives. During the Second Five Year Plan, efforts were made to encourage the formation of labour co-operatives. These cooperatives whose members are workers undertake the contract of government projects, such as, construction of roads, digging of canals and tanks, afforestation, etc. They provide employment to agricultural workers during off-season and also eliminate the possible exploitation of workers by the private contractors. The basic idea of the movement is commendable. The movement has yet to gain momentum in the rural areas.

5. Employment Guarantee Scheme: The Government of Maharashtra introduced in 1977 the Employment Guarantee Scheme under which any able bodied person in rural areas can apply for a job to the collector of the district. Under this scheme, the State assumes the responsibility to provide work on demand. Jawahar Rozgar Yojana launched by the Central Government is a further step in this direction.

6. 20 - Point Programme: In July, 1975, the government introduced the 20 point economic programme which included a number of measures to improve the economic condition of the landless workers and other weaker sections of the community in our villages. These measures are:

- Speedy implementation of ceiling legislation and distribution of surplus land among landless labourers and small peasants,
- Provision of house sites for landless labourers and conferment of ownership rights of the houses if they have been occupying them for a certain period,
- Abolition of bonded labour
- Liquidation of rural indebtedness and moratorium on recovery of debts from landless labourers, artisans and small peasants,
- Review of the minimum wages legislation for agricultural labour and introduction of suitable enhancement of minimum wages wherever necessary.

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